Master Dissertation in Engineering

A Research on The Factors That Influence The Adoption of AI-Based Public Services in The Indonesian Government: Case of Indonesian Covid-19 Chatbot Service

인도네시아 정부의 AI 기반 공공 서비스 도입에 영향을 미치는 요인 연구 : 인도네시아 Covid-19 챗봇 서비스 사례

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Abstract
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Currently, various countries have a national Artificial Intelligence (AI) as a reference to implement the strategies and identify the direction of government policies. AI encompasses a wide range of technologies, one of which is the chatbot platform that can increase efficiency, save time and budget, and provide higher quality public services. Furthermore, in 2019, the Indonesian government released the features of the chatbot platform, which has 2 million users from a total population of 250 million people. Therefore, this study aims to examine the current problems in adopting a chatbot platform using technological, organizational, and environmental (TOE) framework approach. The results show recommendations on the aspects to be considered when adopting AI-based public services.

Keywords: Artificial Intelligence, AI-based public services, Chatbot platform service, TOE framework, adoption intention.

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Chapter 1. Introduction

1.1 Research Background

The covid-19 pandemic has directly increased the emergence of advanced technology and the adoption of digitalization through new tools, methods, and solutions to enhance efficiency and innovation. Furthermore, the development of artificial intelligence (AI) and innovation have been enabled through advanced data collection and aggregation, algorithms, and computer science. In previous years, computer programming language influenced the ability to perform tasks. Currently, they are given more learning tasks and can adapt to new data using "machine learning" systems. On a global scale, many of these systems are introduced into several sectors of finance, health care and transportation to have an extraordinary impact on improving government services (Chitturu et al., 2017). Meanwhile, the availability of big data, cloud services, new algorithms, and machine learning enables artificial intelligence to adapt and emulate human thinking rapidly. With 5G, big data, and blockchain, artificial intelligence is also one of the core technologies in smart city development. Hwang, 2020 stated that smart city plans and manages core functions by effectively using data and digital technologies to become efficient, innovative, inclusive, and resilient. Furthermore, technology such as big data provide rich information (structured/unstructured data, sensor data, audio, video, etc.) from the lifeblood of intelligent solutions. Several countries use the AI application to enable interaction between users and the system in a direct conversation format with humans. Poola, 2017 stated that the technology is

known as chatbot, and it understands environmental patterns, interacts verbally and serves as interfaces in speech. Chatbot is an AI-based software developed to speed up communication between users and private/government management.

Furthermore, Google now, Alexa and Siri are chatbot applications used in private sector to provide news, order airplane tickets, or conduct banking transactions. In the first generation of the application platform, the system was minimal and only respond to simple queries. In its current development, more complex queries and proactive transactions are performed. Furthermore, the public sector has also adopted chatbots to improve services in health, education, taxation, and several fields (Androutsopoulou et al., 2019). The chatbot platform assists the government to saves cost, reduce the workload of civil servants, shorten bureaucratic processes, accelerate decision making, and improve public services as well as citizen satisfaction. It is also a solution in advancing and accelerating public services that have become a problem for a very long time.

After the 1998 political reforms, the Indonesian government continues to improve bureaucracy in governance, and the public perception points up that the performance was not optimal. Even the public seems reluctant to deal with the bureaucracy because it is always related to decreased level of services, corrupt behavior, low professionalism, and slow decision-making. For a long time, the Indonesian government has improved the performance of the bureaucracy, and no significant change was felt in terms of public services. In addition, the bureaucracy is an administrative service that primarily depend on

organization's performance (Ralph M. Stogdill, 1971) based on internal and external factors (Interplan, 1969). The success of the bureaucracy in providing services refers to the pattern of interaction between two related parties such as the organization (government) that provides services and the community (citizen). Also, the Indonesian government has set a 2020-2024 national bureaucratic reform road map through the Ministry of Administrative and Bureaucratic Reform. This produces a world-class bureaucracy (world-class bureaucracy) of increased quality public services as well as effective and efficient governance. The five quick wins established are the simplification of the bureaucracy, performance management, improving the quality of human resources, fast, flexible governance through an Electronic-Based Government System (SPBE), and excellent public services. This step was taken to resolve the bureaucratic problems delivered by president Joko Widodo at the International Conference 2019 in Jakarta. It aims to reduce the long bureaucracy that hinders investment and increase the role of the government in providing fast and accurate public services towards a smart nation. Furthermore, a direction was given to the Minister of administrative and bureaucratic reform to implement artificial intelligence and enhance bureaucracy and decision-making. The statement was strengthened by analysis from Delloite International Institution in 2019, where the benefits of implementing artificial intelligence was explained. A study conducted by McKinsey Global Institute estimated that there are 52 percent of all activities within the Indonesian government with the potential to automate work and adopt artificial intelligence. Furthermore, technical feasibility is not the only factor affecting the automation

of jobs since the costs involved in adopting AI systems are also considered Therefore, central and local governments will need to develop new workforce skills (Chitturu et al., 2017).

To support the President's direction, the government, through the Indonesian Agency for the Assessment and Application of Technology, prepared a national AI strategy 2020-2045. It points out issues related to the importance of implementing AI with a focus on four areas. These areas include ethics and policies, talent and skills development, data and infrastructure, and research and industry innovation. Besides, the government has also set five priority sectors to succeed in the national artificial intelligence strategic missions. These include health services, bureaucratic reform, research and education, the resilience of food, and smart city (smart mobility). The strategy provides several development plans to improve public and government services, chatbot platform and robotic automation system, personal identification with face recognition, voice, and other types of biometrics, sentiment analysis, and government big data analysis.

1.2 Research Purpose

With the various benefits generated in government circles, artificial intelligence greatly influences services to its citizens. To explore this potential, governments need to understand the implementation of AI, which can be shown through different approaches. Furthermore, the AI should be adopted through adaptation and innovation, and tools should be prepared from this technology.

Building and training high-quality and representative data require appropriate infrastructure for citizens' usage and transmission (Shearer et al.,

2020). Currently, many countries are experiencing the Covid-19 pandemic, and all activities and services in the private and public sphere are conducted through online study. Indonesia is expected to serve the citizens effectively and efficiently, as an archipelagic country consisting of approximately 17.000 islands and 250 million population. In 2019, through the ministry of communication and information technology, the government collaborated with WhatsApp and the Telkom group (Indonesian telecommunications company) to create a national pilot project that provides essential information related to covid-19. The information provided by this chatbot includes the understanding and symptoms of the pandemic, the location of referral hospitals, and others. Based on the Ministry of Communication and Information Technology data, approximately 40 thousand messages are processed by the system, with around 2.7 million users, and this number is extremely far from the government's expectations.

Only 1% of the total population uses the chatbot service, and another problem that supports the implementation is the lack of efficiency in national ICT spending. Total government spending for software (applications) and hardware in 2014 - 2016 reached more than $840 million with an average of $28 million per year. This trend continues to increase every year (Presidential Regulation, 2018) and was also explained that 65% of software (application) expenditures, included licenses to build similar applications between government agencies. Based on a data center infrastructure survey conducted by the Ministry of Communication and Information Technology in 2O18, there were 2,700 Data Centers in 630 Central and Local Government Agencies

(MCIT, 2018). Therefore, there are 4 Data Centers in each government agency on average. Nationally, the utilization of Data Center and hardware only reach an average of 30% of its capacity. This fact shows the lack of coordination between government agencies. The development of eGovernment has resulted in duplication of ICT spending and capacity that exceeds public needs and services. This is far from expectations due to the lengthy bureaucracy and slow decision-making described above. For example, it takes 200 days to process a permit application, and approximately 18 procedures passed by the submitting party (World Bank, 2018). The Indonesian government took the initiative of adopting a chatbot platform to solve citizen problems more quickly, provide convenience and integrated public services as well as save the government's ICT costs. Based on the problems and explanations above, this study will focus on the following questions:

1. What are the current problems in adopting the AI-based public service (Case of Indonesian Covid-19 Chatbot service) in the Indonesian government?
2. What factors are influential when adopting The Chatbot Platform in the Indonesian Government?
3. What aspect should the Indonesian government focus on adopting AI-based public service?

This study focuses on the current conditions, the problems related to the implementation of the chatbot platform, and the most influential factors in adopting the system in the government sector. Furthermore, it also focuses on the aspect of applying AI-based public service by examining technological,

organizational, and environmental dimensions of intention to adopt the service in governance.

1.3 Scope of the Research

This is a theoretical study conducted using a technological, organizational, and environmental (TOE) framework approach. The TOE framework represents several dimensions that can influence the adoption and implementation of innovations at the organizational level. Furthermore, it focuses on the problems faced by the government by analyzing theory, reviewing existing literature, interviews, and also supported by the questioner. This is concerned with the implementation of the chatbot platform in the Covid-19 case and the influencing factors in the adoption within the government sector. Finally, this study is expected to have implications for theoretical, practical, and recommendations on the aspect to be focused by the government when applying the service of the application.

1.4 Research Methodology

This study uses a qualitative and quantitative method. Quantitative methods are concerned with variable or numerical data analysis using specific statistical approaches. The data collection was conducted through interviews, literature studies, and surveys to test and analyze the TOE framework theoretical model. Several variables were developed from interviews and literature reviews to identify appropriate and valid measurement indicators. Furthermore, the questionnaires were distributed to central and local governments that have implemented or will implement chatbot services in public services.

Chapter 2. Theoretical Background and Hypotheses Development

2.1 Platform

The term platform comes up frequently in the field of information technology and is also an essential part of software development. It defines the standards used for system development and provides a base of software components (i.e., software applications) that support core functions. In addition, it can be extended through external software components that use the standard interface of the platform. The platform can be modified to support the interoperability process, which is often a bottleneck in the development process. It gives access to the innovation resources and allow third parties to take advantage. Furthermore, it encourages developers and third parties to participate in innovation (Kim & Altmann, 2020). Platform providers are not limited to providing resources but also have to design the architecture and business model of the platform to be developed. In addition, they should determine how to attract users to be interested in using developed platform.

Platform providers play an essential role in leading the innovation process in an ecosystem. The combination of the providers with the parties determines the success of a platform's innovation. For example, it provides incentives to third parties since platform development is the impetus for designing strategies and developing valuable software. In addition, the provider is the core of the service cluster, while the third party complements the developed platform. This is because many of the third parties will access the platform through the service software, which allows new knowledge received

by the platform provider. Currently, many IT services are developed without providing the ability to integrate with other platforms. This will increase the user's dependence on the platform provider, which explains the low level of acceptance. A solution to this issue is to apply interoperability and portability in the service platform offered. Portability is a characteristic and service component developed on a different platform from the origin. Meanwhile, interoperability is the ability to interact with other service platforms having various unique properties (Haile & Altmann, 2018).

2.1.1 Platform Issues

Several issues regarding service platforms related to interoperability and portability include programming frameworks, application programming interfaces, and data formats (Haile & Altmann, 2018). Platform providers have software development tools that they often use. Therefore, when there is an offer of a service platform with new tools, the cost of learning framework technology is increased. Furthermore, the next issue is the incompatibility of the application programming interface in uploading, downloading, checking, and configuring the service, which is similar to what happened to the Data pipe and Amazon EC2 API. The solution is to provide virtual machines such as VMware, KVM, and Xen that allow their services to be developed on various platforms. Also, the data format is also a problem in the development of service, and the absence of data standards used in translating formats from one application to another causes additional costs to develop the conversion tools. Primarily, the costs incurred and the benefits to be gained primarily affect the adoption of innovation.

The technical and human aspects play an essential role in implementing the impact of the platform on innovation adoption. Meanwhile, the transition to a platform strategy is not easily accepted. It was assumed that there is no difference with the use of service platforms, considering changes to be uncomfortable and also challenging to adapt from the human aspect. In a broader context, the management of an organization refuses to join other units with the same platform because merging into one will eliminate the components. This is the biggest challenge in the integration process of the platform. Then, an understanding of the domain is needed to determine the variables and the impact of the components used (Ghanam et al., 2012).

2.1.2 Security Issues

The level of cyber-attacks has increased since almost all activities are conducted online during the pandemic. For example, online learning platforms have frequently experience cybercriminals, and in June 2020, the number of DDoS attacks affecting educational resources increased by at least 350 percent compared to the same month in 2019. Furthermore, leaking of personal, corporate, and state data due to cyber-attacks continues to be the topic of discussion. Cloud adoption also experience growth in terms of infrastructure and industry. IoT and 5G will connect many devices into one platform to support industrial and community activities requiring the provider to ensure data security. In addition to detection systems (IDS), virtual private networks (VPNs), access controls, and content filters should be innovative to overcome serious cyber-attacks.

Currently, sharing cybersecurity information is one of the solutions to

overcome and prevent cyber threats. The role of stakeholders, the structure of the information-sharing model, information exchange methods, processing, regulations, and policies are very influential in this cybersecurity information-sharing ecosystem.

With precise and accurate information platform providers can make decisions to update security systems for reducing risks and ensuring the security of user data. The costs incurred to use this solution include maintenance costs, management subscription fees, costs to support end-users, and to improve the quality of service (Rashid et al., 2021).

2.2 Indonesian Government Policy

National Long-Term Development Plan for 2005-2025 (RPJPN) is a development planning document for a period of 20 (twenty) years established to provide direction as well as a reference for all components of the nation (government, community, and the business world) in realizing ideas and goals under the vision, mission, and direction of development. It is mutually agreed upon since all efforts made by development actors are synergistic, coordinative, and complement each other in a pattern of attitude and action. The RPJPN explains that Information and Communication Technology is one of the national priorities, and also recognizes ICT as the backbone of national development. Currently, the Indonesian government is in a phase to accelerate development in all fields by shortening the bureaucracy and speeding up decision-making.

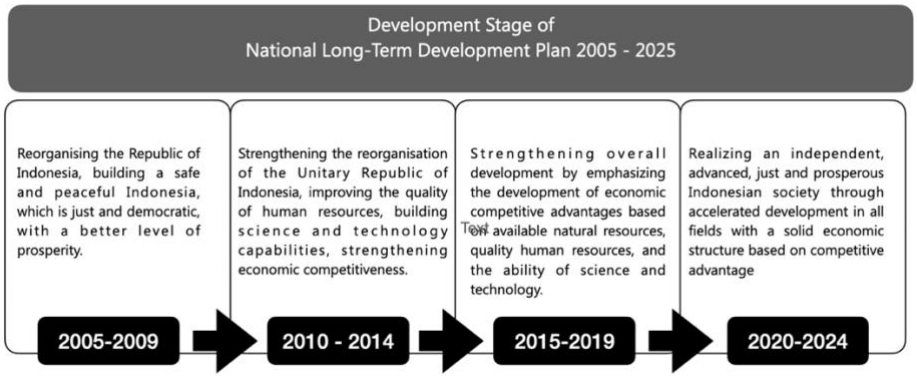

Figure 1. National Long-Term Development Plan for 2005-2025

The Indonesian government made the National Medium-Term Development Plan (RPJMN) from long-term development, as shown in figure 1. This document is a plan for five years which consists of:

1. RPJMN I Years 2005-2009;
2. RPJMN II 2010-2014;
3. RPJMN III 2015-2019;
4. RPJMN IV 2020-2024.

The National Medium Term Development Plan (RPJMN) 2020-2024 is the last stage of the National Long Term Development Plan (RPJPN) 2005-2025, therefore, it is crucial. The 2020-2024 RPJMN will have an impact on achieving the development targets, where Indonesia's per capita income will reach a level of welfare equivalent to that of an upper-middle-income country (MIC) which has infrastructure conditions, quality human resources, public services, as well as the welfare of the people.

There are four pillars of the 4th RPJMN for 2020-2024: the mandate to achieve the main objectives of the last period of the national development plan, as shown in figure 2. The four pillars are translated into seven development

agendas: Priority Programs, Activities, and Projects. The objectives of RPJMN IV for 2020 - 2024 are in line with the Sustainable Development Goals (SDGs). Furthermore, the targets of the 17 goals (goals) in the Sustainable Development (SDGs) and their indicators have been shown in 7 development agendas, as shown in figure 3.

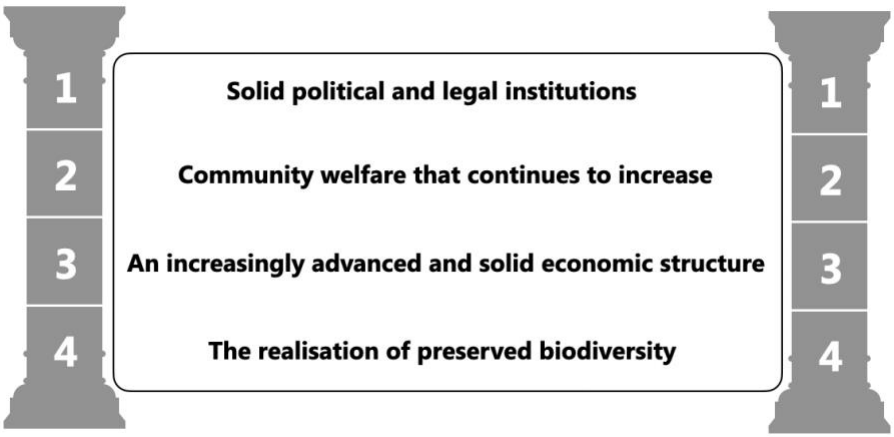

Figure 2. 4 (four) pillars of the 4th RPJMN for 2020-2024

Figure 3. 7 development agendas of the Indonesian government

Currently, the world has entered the era of the industrial revolution 4.0. This revolution provides challenges and opportunities for future economic development. In contrast, digitization, automation, and artificial intelligence in economic activities will increase productivity and efficiency in modern production and provide convenience and comfort for consumers. Digital

technology also helps the development process in various fields, including education through distance learning, government through e-government, financial inclusion through fintech, and the development of SMEs as well as e-commerce. But on the contrary, industrial revolution 4.0 can cause job losses in the world. It is estimated that 51.8 percent of potential jobs will be lost Also, the growth of various business activities and online-based buying and selling has not been accompanied by efforts to optimize state revenues and monitor tax compliance on these transactions. It is crucial considering that digital transactions are cross-border. To lead to the 4.0 industrial revolution, the Indonesian government has made several strategies such as the Indonesian government roadmap and Broadband plan, the movement towards 100 smart cities, and the National Artificial Intelligence Strategy.

2.2.1 Roadmap eGovernment

In 2015 the Indonesian government held a workshop to follow up on the 2015-2019 RPJMN through the Ministries of Communication and Information Technology, and Administrative and Bureaucratic Reform. The results agreed to develop eGovernment with ten priority areas including health, education, population, food sovereignty, maritime and marine affairs, tourism, investment and business licensing, labour, border areas, and government (MCIT, 2017). In principle, this innovation improves the quality of service from government agencies to the public through online services. The use of e-government includes e-budgeting, e-procurement, e-audit, e-catalogue, e-payment, e-control, and even e-health. Figure 4 showed that this system supports performance in government to business, government to citizens, government to

government, and government to employees. The positive impact of its implementation is that the public can receive reports on actual and transparent government performance. Furthermore, public can freely access information about government performance can be freely accessed. With online technology, work will undoubtedly be more efficient in terms of cost and time since adopting an e-government system that is very accessible and transparent can lead to a good and open government. The strategies used in implementing the e-government system include;

- Developing a reliable and affordable service system for the broader community with an even communication network.
- Conducting systems and work processes of government by preparing human resources that are familiar with the technology.
- Utilizing information and communication technology optimally by providing complete information.
- Increase business participation and develop the telecommunications and information technology industry.
- Conduct systematic development through realistic and measurable stages through preparation, maturation, consolidation, and utilization.

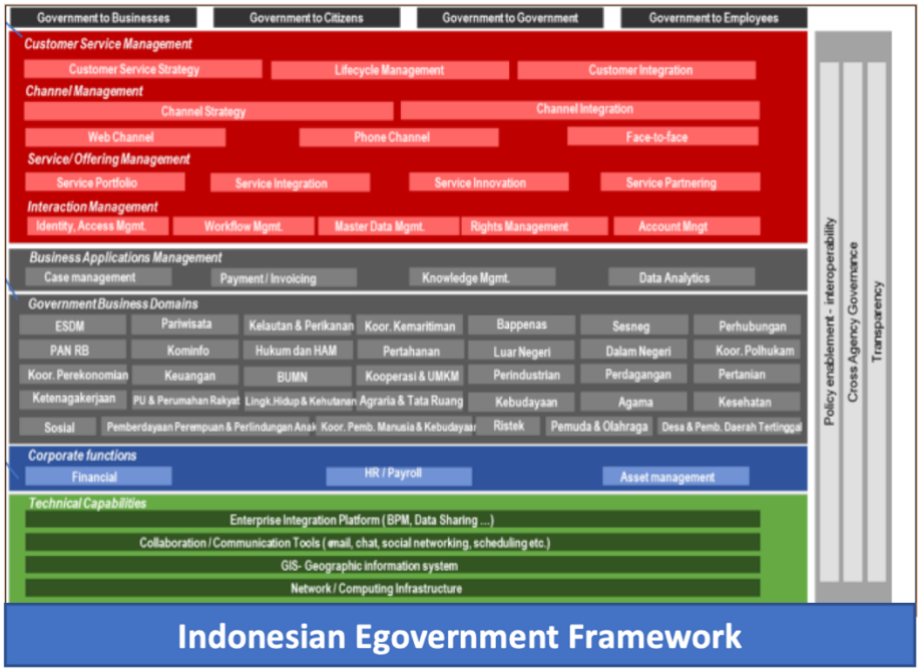

Figure 4. Indonesian eGovernment Framework (MCIT, 2017)

In 2018, the Indonesian government issued presidential regulation number 95 of 2018 concerning electronic-based government systems to improve the integration and efficiency of the national electronic-based government system management as well as develop the previous eGovernment framework. National electronic-based government system Master Plan is a system development planning document for 20 (twenty) years. This document also describes the electronic-based government system architecture, as shown in figure 5. This describes integrating business processes, data and information, infrastructure, applications, and security to produce integrated services. Indonesian President appointed seven ministries to be responsible for the implementation of the strategy. These ministries include the Ministry of State Apparatus Empowerment and Bureaucratic Reform, the Ministry of Communication and Information, the Ministry of Home Affairs, the Ministry

of National Development Planning, the Ministry of Finance, the Head of the Agency for the Assessment and Application of Technology, and the head of the national cyber and crypto agency.

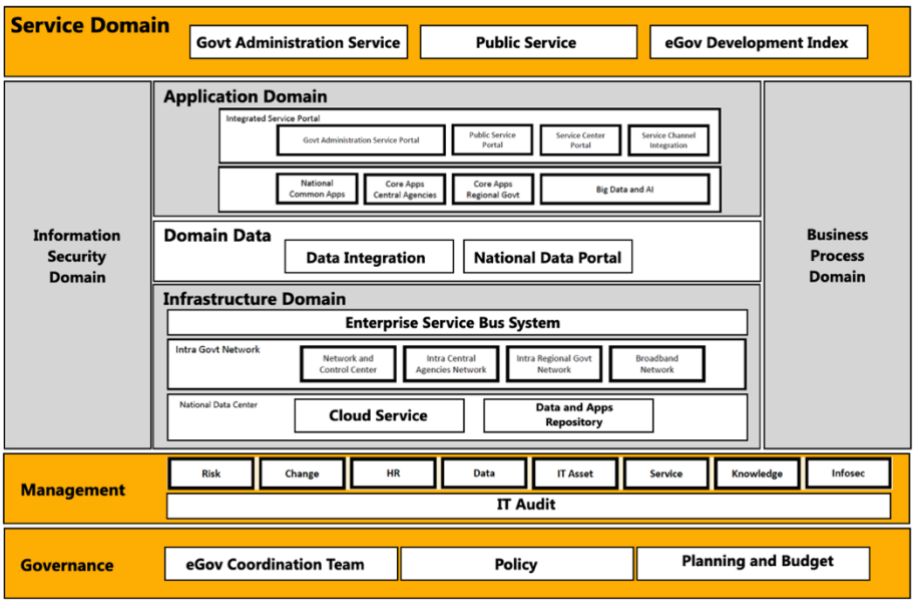

Figure 5. eGovernment Architecture (Reform, 2021)

This strategy is an ongoing effort in the development of the state apparatus to create a competitive nation. By the end of 2025, the Indonesian government aims to achieve integration and connectivity between Central and Regional Governments. Then the business process between Central and Regional Governments will form a whole and comprehensive, unified government and produce high-performance bureaucracy and public services. The very rapid development of ICT provides opportunities for innovation to improve public services. Future ICT trends can be adopted selectively according to the internal and external environmental conditions of the Central and Local Governments to support electronic-based systems. Some of the proposed technologies in this strategy are 5G, Cloud Computing, Big Data Analytics, Internet of Things, and

Artificial Intelligence.

2.2.2 Indonesian Broadband Plan

In line with global changes that place broadband as the key to development, Indonesia also encourages the development to realize the vision of 2025, such as an independent, advanced, just, and prosperous society. Steps were taken by paying attention to four things: the mandate of the constitution, the vision of Indonesia's transformation in 2025, reforms and the direction of national development, and efforts to increase competitiveness at the global level. Currently, the reach of ICT infrastructure to all regions and levels of society is not optimal (Presidential Regulation, 2018). ICT infrastructure, particularly telecommunications networks, is a pillar of connectivity between operators and users of electronic-based government systems. Furthermore, the effectiveness of the systems depends on the level of user access through telecommunications networks. The Indonesia Broadband Plan 2014 - 2019 is prepared to provide guidance and direction for national broadband development. Synergy and collaboration are the keywords for successful development. Currently, broadband has an essential role in creating conditions for sustainable economic growth and improving people's welfare. The use of broadband affects economic dynamics and social welfare because it encourages increased sectors and economic activities. The direct effect is in the form of factors that drive growth, such as innovation, the emergence of new goods and services, new processes and business models, as well as increased competitiveness and flexibility in the economy. Fixed broadband penetration of 1% is expected to reduce the unemployment rate by 8.6%. About 10% of broadband penetration is targeted

to encourage economic growth of 1.38%. In strengthening the ICT sector, the availability of broadband coverage in all regions can indirectly strengthen the National Connectivity from the linkage of ICT with the National Transportation System, National Logistics System, and Regional Development, which form the National Connectivity framework. The benefits include:

1. On the Island / Economic Corridor
    a. Development of extension networks and backbones to growth centers and main activity centers;
    b. Equitable access to ICT infrastructure to key growth and activity centers to strengthen the backhaul link network;
    c. Development of broadband networks especially fixed access broadband;
    d. Appropriate radio frequency spectrum allocation;
2. Inter-Island / Economic Corridor
    a. Multi-mode integration of the telecommunications backbone (optical fibre, satellite, microwave);
    b. Strengthening fibre optic backbone infrastructure; and
    c. The application of ICT enhances the trade and development of an open and neutral electronic portal to facilitate the exchange of port data and information services in a fast, safe, neutral, and accessible manner. It is integrated with relevant government agencies, port business entities, and logistics industry players to improve logistics competitiveness in a community system (Inaportnet) at a regional port.

3. International

    a. Opening new international channels and gateways for overseas telecommunications services as an alternative; and

    b. The development of international internet exchange as a growth center.

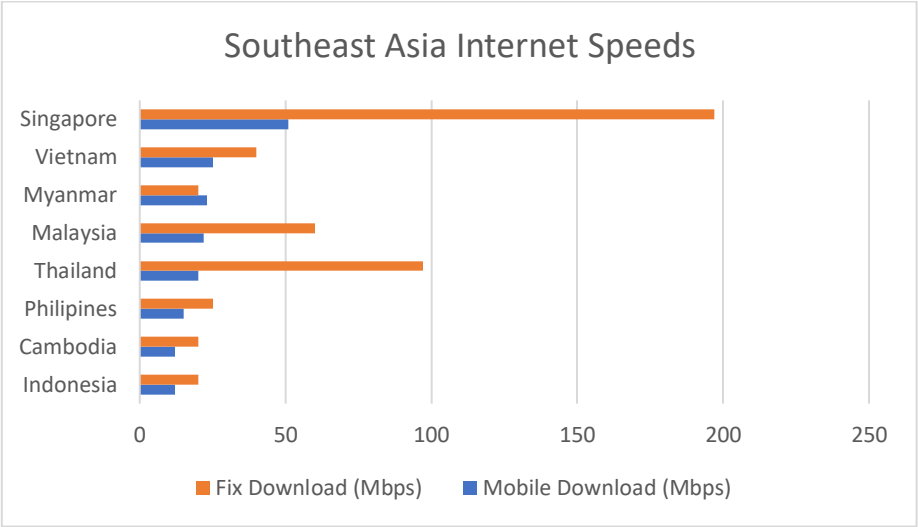

Figure 6. Internet Download Speeds (Beschorner & Rees, 2020)

In contrast, the low penetration of internet users also describes optimal utilization of ICT infrastructure, especially broadband networks by the community. Based on the Internet Usage Penetration survey results in 2017 by the Association of Indonesian Internet Service Providers (APJII) showed a value of 54.68% (143.26 million internet users from a total population of 262 million in Indonesia). Meanwhile, the distribution of internet user penetration rates by region is 57.70% in Java, 54.23% in Bali and Nusa Tenggara, 47.2% in Sumatra, 72.19% in Kalimantan, 46.7% in Sulawesi, and 41.98% in Maluku and Papua. The low penetration of internet users is caused by limited quality (speed) and broadband network capacity as shown in figure 6.

2.2.3 The movement towards 100 Smart Cities

The movement towards 100 Smart Cities is a joint program of the Ministry of Communication and Information, Ministry of Home Affairs, Ministry of PUPR, Ministry of Development Planning, and Presidential Staff Office. It aims to guide districts/cities in compiling a Smart City Master Plan to maximize the use of technology, improve community services, and accelerate each region's potential. According to the International Telecommunication Union (ITU), there are more than 100 definitions of a smart city. Therefore, there are no specific definitions of a smart city. Each definition always contains these keywords such as ICT, environment and sustainability, and infrastructure and services. A smart city plans and manages the core functions by effectively using data and digital technologies to become efficient, innovative, inclusive, and resilient (World Bank, 2020). The scope of its fundamentals is sustainable development, environmental sustainability, urbanization, data and integrated technologies, infrastructure, and services, integration of the physical, digital and human system. Through the concept, government services can be faster and impact society. Technology does not solely belong to urban communities. However, current technology should also be accessible in rural areas. With internet network access, rural communities can access it. This can increase regional productivity and economic competitiveness. Fiscal issues often escape the attention of regions to develop smart cities in the context of implementing the movement, and about 100 were initiated by the central government. The Minister of Communication and Informatics (MCIT) stated that there are 514 districts/cities. With such a large number, the development of smart cities in the

regions cannot be conducted. It needs careful calculations, one of which is from a budget point of view.

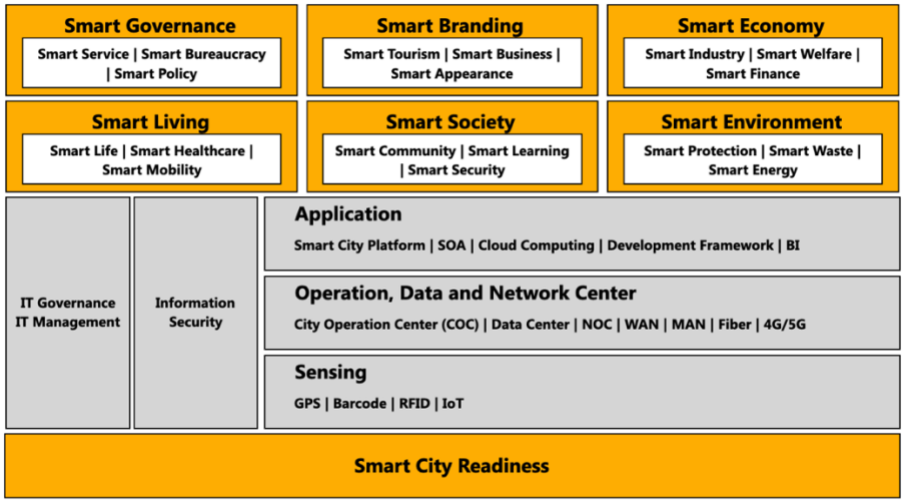

Figure 7. Smart City Architecture & Information Technology Framework (MCIT, 2019)

In a previous study regarding smart city readiness, several facts were obtained, including (Hidayanto et al., 2018):

1. The organization is the most significant factor in adopting the smart city concept.
2. There is a need for collaboration with external parties to develop technology and innovation in the concept of a smart city.
3. The funding factor also affects the concept adoption of the smart city.

Furthermore, the problems faced by the Indonesian government in the adoption of the smart city concept are funding and limited human resources.

2.2.4 National Artificial Intelligence Strategy

Following the current rapid development of technology, in July 2020, the Indonesian Government formulated a national artificial intelligence strategy. It

is a national policy direction that contains focus areas and priority areas for artificial intelligence technology as a reference for ministries, agencies, local governments, and other stakeholders in carrying out activities in artificial intelligence technology. This document is written and compiled as a formulation of the discussion of the results from the Working Group. It is used for Developing a National Strategy for Artificial Intelligence established by the Agency for the Assessment and Application of Technology. This group consists of several experts representing Ministries in Indonesia, National Agencies / Institutions, Universities, Industry, Associations, and Communities in Artificial Intelligence. The application can provide increased productivity for the business world, investment efficiency in the use of human resources, and innovation in various sectors, such as finance, health, education, agriculture, defense and security, transportation, and maritime affairs. Furthermore, it can provide adequate public services, plan quality educational resources, and help governments formulate appropriate policies. To support the national artificial intelligence strategy, the Indonesian government has four Focus Areas, namely Ethics and Policy, Talent Development, Infrastructure and Data, and Industrial Research and Innovation. The implementation also set five priority areas used as artificial intelligence pilot projects in the early stages. As shown in figure 8, the five fields are health services, bureaucratic reform, education and research, food security, and mobility in smart cities (BPPT, 2020).

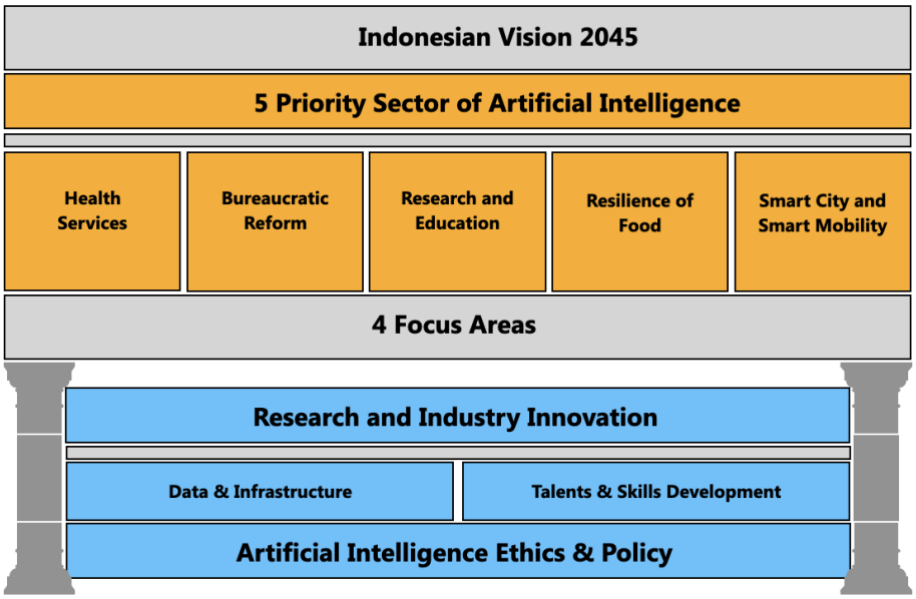

Figure 8. Artificial Intelligence National Strategy Framework

Some of the initiatives in bureaucratic reform are developing a Chatbot platform for government services, developing a robotic process automation system, personal identification using face recognition, voice, and other types of biometrics, and big data analysis. There has been no study related to the readiness of the Indonesian government to implement AI technology.

2.3 Artificial Intelligence

Technological developments are currently developing very rapidly. Towards the 4.0 industrial revolution, every country competes to adopt the Internet of things, big data, and artificial intelligence. Meanwhile, developed and developing countries are increasingly interested in Artificial Intelligence in the banking, manufacturing, transportation, and government sectors. Adopting this technology is buying and then installing the technology. However, it requires mature readiness from the organization or government (*Deloitte*, 2020). Artificial intelligence is a computer programmed to perform the tasks of

humans. It includes the ability to understand and monitor information from a visual/spatial perspective. Furthermore, the system can interact with humans and machines, make predictions, and continue to learn to follow needs. AI can be trained and given input from time to time to improve its abilities. In public services in the government sector, a large amount of data is usually processed daily. Their weakness is a lack of resources since the service process becomes slow. There are three types of Artificial Intelligence products and services, namely automation of digital and physical tasks (Robotics and Process Automation), algorithms for detecting patterns in volume data is enormous.

By utilizing this technology, the process can be automated to be faster, more effective, and efficient. In contrast, the Government should be prepared for other problems after adopting Artificial Intelligence technology, such as employees since their roles will be replaced after AI replacement.

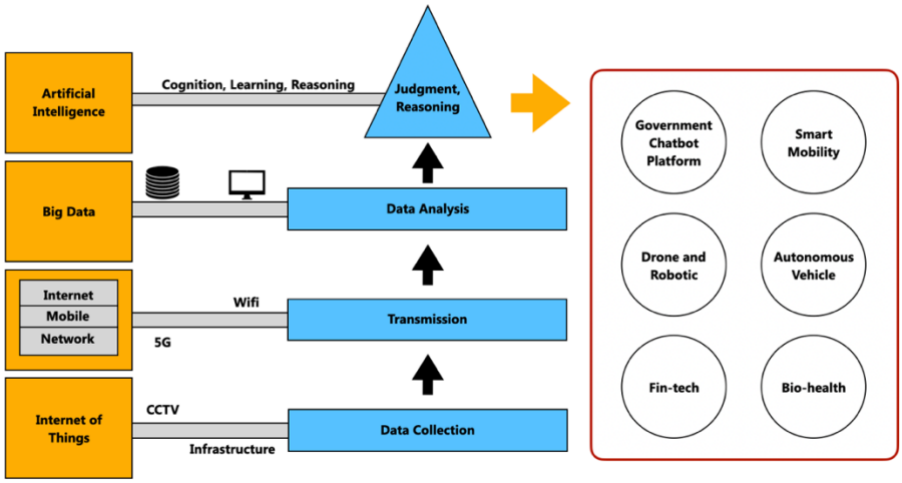

Figure 9. Artificial Intelligence Utilization (NITI Aayog, 2018)

Artificial intelligence capabilities have the potential to provide better services to society. The essence is data, the extent to which AI can dig deeper with substantial data sets, and also this relationship to its privacy will affect AI

outcomes. This includes fingerprint technology, facial recognition, and eye retina scanning should be strictly regulated for AI systems to follow ethical corridors and personal data protection regulations.

2.3.1 Chatbot Platform

Chatbots are applications that can interact between users and the system virtually in a direct conversation format like direct with humans (Poola, 2017). Many chatbot platform applications are currently adopted by the government sector, especially in health, education, licensing, population, and other fields, as presented in table 1. In the government sector, the length of the bureaucracy and the slow decision-making in public services has been a longstanding problem. In addition, the presence of artificial intelligence technology through virtual assistants can automatically answer what is needed by the community, and interacting with humans is a solution to existing problems. Several fields, such as population, immigration services, and taxation have used the chatbot platform system. According to a study conducted by Mehr in 2017, there are five classifications of chatbots implementation, including:

1. Translating government information;
2. Compiling documents tailored to the needs of community members;
3. Responding to questions, complaints, and inquiries from community members;
4. Seeking and processing documents submitted by members of the community; and
5. Receive input from the community and forward it to related parties.

This chatbot will get more intelligent when they often interact with humans, and the accuracy of the answers will increase with time. By implementation, it will increase the interaction between the government and the community. The use of chatbot platforms also minimizes the spread of covid-19 because the community does not need to come directly to government offices or meet employees. Furthermore, chatbots can also provide suggestions or choices to people that need information regarding their questions or complaints (Atkinson et al., 2017). Chatbots are open since they can be combined with other technologies such as IoT, Big Data, face recognition to be processed according to needs.

Table 1. Chatbot platform in government

No	Chatbot Platform	Responsibility	Country
1	Dasomi	Talks to elderly people when they do not speak for 30 minutes or more and automatically calls to a guardian and life manager when they do not move for more than 5 hours.	South Korea
2	Ask Jamie	Greater convenience and accessibility to the government for 24/7 and get help without the need-to-know which agencies to	Singapore

		go to	
3	Alex	It intended to help the people and businesses with taxation, property rights, income & deduction, filing returns, and taxation.	Australia
4	PMC	Provides information like complaint registration, online services, tax filing, health issues, finance, driving license info, and many more.	India
5	Paige	This application is built on Facebook's NLP platform. PAIGE assists the employees in San Francisco government agencies with the digital/IT procurement process. This application keeps employees free from all the hectic procedures in the government	San Francisco

		procurement process.	
6	Rammas	This is the first-ever government chatbot application launched on the Google AI platform. This bot application comes with the capabilities to take people's requests (inquire and pay bills) 24/7, process the data, and make decisions with greater accuracy. It is one of the best chatbot applications that make AI to the fullest.	Dubai

2.3.2 AI Ethics

Artificial Intelligence is developed and used with a purpose for the positive benefit of humans. With a goal orientation, this is expected to generate public trust in artificial intelligence. Meanwhile, there are various positive impacts of artificial intelligence in various social and economic sectors felt by humans. To achieve this goal, AI ethics is fundamental in the implementation, and it is closely related to data ethics, which explores moral issues from creation, mutilation, processing to use. AI technology has broader freedom than

programmed computers since ethical issues will be easier to find in its implementation. As presented in table 2, many countries worldwide mainly develop guidelines for AI ethics in the public or private sector. There are eleven crucial aspects found in these guidelines: responsibility, privacy, transparency, justice and fairness, non-crime, freedom and autonomy, generosity, sustainability, trust, dignity, and solidarity.

Table 2. AI Ethics Guidelines in Around the World (Jobin et al., 2019)

No	Name of Document	Issuer	Country
1	Artificial Intelligence. Australia's Ethics Framework: A Discussion Paper	Department of Industry Innovation and Science	Australia
2	AI Guidelines	Deutsche Telekom	Germany
3	Discussion Paper: National Strategy for Artificial Intelligence	National Institution for Transforming India (NITI Aayog)	India
4	Discussion Paper on Artificial Intelligence (AI) and Personal Data—Fostering Responsible Development and Adoption of AI	Personal Data Protection Commission Singapore	Singapore

5	Mid- to Long-Term Master Plan in Preparation for the Intelligent Information Society	Government of the Republic of Korea	South Korea
6	IBM's Principles for Trust and Transparency	IBM	USA
7	Responsible AI and Robotics. An Ethical Framework.	Accenture UK	UK

The role of stakeholders in aligning AI technology is in terms of the ethical principles and their application. By conducting a bottom-up approach, the organizations or experts will mediate between the government and all stakeholders to formulate cultural and moral differences that might be found in AI implementation.

2.4 TOE Framework

Tornatzky and Fleischer, 1990 listed several factors that influence the adoption and implementation of a technology or innovation in an organization. As shown in figure 10, these factors consist of technology, organization, and environment to form a TOE framework (Tornatzky, L. & Fleischer, 1990). Technology factors are seen from the internal and external sides of the analysis. Organizational factors consist of structure, leadership, quality of human resources, and size. Then the environmental factors analyze the government,

society, competitors, regulations, and governance. This framework aims to identify the extent of readiness and the need to adopt innovations or technologies.

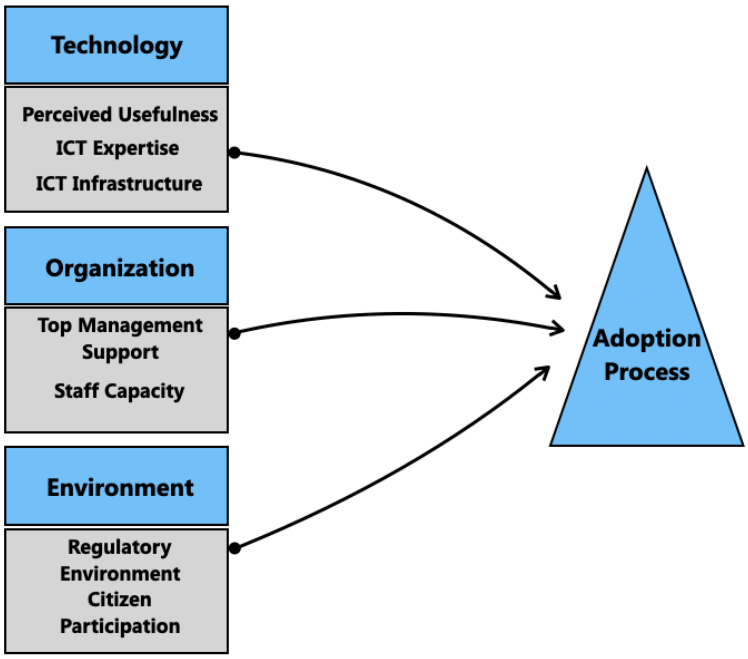

Figure 10. The TOE Framework

The TOE framework has been widely applied in various forms of study to prove readiness to adopt innovations or technologies through empirical and theoretical support, as presented in Table 3. It does not explicitly describe all the factors in the adoption process but rather into the context in which the adoption of innovation or technology is conducted (Ismail & Ali, 2013; Ven & Verelst, 2011).

Table 3. TOE Framework in Various Sectors

No	Topic	Author	Year
1	A perception-based model for EDI adoption in small business using a technology–organization–environment framework.	Kuan, K. K. Y., & Chau, P. Y. K.	2001
2	Understanding e-business adoption across industries in European countries.	Oliveira, T., & Martins, M. F.	2010
3	E-government, e-business, and national economic performance	Shirish, C. S., & Teo, T. S. H.	2010
4	Determinants of E-Government Assimilation in Indonesia: an empirical investigation using a TOE framework	Pudjianto, B. & Zo, Hangjung & Ciganek, Andrew & Rho, J.J..	2011
5	SMEs adoption of enterprise applications: A technology-organization-environment model	Ramdani, B., Chevers, D., & Williams, D.	2013
6	An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan	Lian, J., Yen, D., & Wang, Y.	2014

	hospitals.		
7	Predicting e-readiness at firm-level: An analysis of technological, organizational and environmental (TOE) affects one-maintenance readiness in manufacturing firms	Mohamed Gamal Aboelmaged	2014
8	Factors affecting hotels' adoption of mobile reservation systems: A technology-organization-environment framework	Wang, Y.-S. et al.	2016
9	Smart City Readiness Model based on Technology-Organization-Environment (TOE) Framework and its effect on adoption decision.	Made Ayu Aristyana Dewi , Achmad Nizar Hidayanto , Betty Purwandari, Meidi Kosandi, Nur Fitriah Ayuning Budi	2018
10	Social commerce adoption using TOE framework: An empirical investigation of Saudi Arabian SMEs	Salma S. Abed,	2020

2.5 Structure Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a statistical technique that analyzes the pattern of relationships between latent constructs and their indicators, latent constructs with one another, and direct measurement errors. SEM allows the analysis of several dependent and independent variables directly (Hair et al., 2013). Furthermore, it includes techniques used to build and test statistical models, usually causal models. SEM is a reasonably analytical solid technique because it considers interaction modeling, nonlinearity, correlated independents, measurement errors, correlated error terms, and multiple latent independent variables. In addition, many indicators measure one or two latent dependent variables. SEM includes statistical tools used to solve multilevel models simultaneously, which linear regression equations cannot solve. It can also be considered as a combination of regression and factor analysis. Generally, SEM consists of two main parts, namely a measurement and a structural model.

1. Measurement Model

   The Measurement model depicts the relationship between latent variables and their indicators. Straight arrows show the relationship of latent variables towards each indicator. Furthermore, there are also straight arrows from the error and disturbance terms towards the respective variables, or there is no direct effect or straight arrows that connect the latent variables. The measurement model is evaluated as any other SEM model using the conformity test measurement. Meanwhile, the analysis process can only be continued when the measurement model is valid. In the measurement of outer model SEM-

PLS, a Convergent Validity examination analysis is conducted, consisting of an individual item reliability test, internal consistency, Average Variance Extracted (AVE), and a Discriminant Validity examination.

2. Structural Model

   The structural model describes the relationship between latent or between exogenous and endogenous variables. This structural model is a set of exogenous and endogenous variables with direct or demonstrated effects. The structural model consists of measuring the path coefficient (β), R^2 (coefficient of determination), t-test f^2 (effect size), and Q^2 (predictive relevance).

2.5.1 SEM Relationship Model

Reflective and normative models are the two types of relationship models in SEM. The formative relationship model describes the causal relationship of indicators to latent variables since changes that occur appear in latent variables. In comparison, the reflexive relationship model describes each indicator as a measure of error aimed at latent variables (Hair et al., 2013). Meanwhile, the characteristics for the reflexive relationship model in SEM are (Henseler et al., 2009):

- The direction of the causality relationship is formed from construct to indicator.
- Calculates the measurement error (error) at the indicator level.
- The indicators should be correlated with each other (have internal consistency reliability)

- Removing one indicator from the measurement model does not change the construct.

A unified form of reflexive relationship model in SEM is called a reflexive construct. The construct can be interpreted as a concept that has been limited in definition (elements, features, and properties) to be observed and measured. X1, X2, and X3 show the relationship model as manifest variables (indicator) while Y is a latent variable. The reflexive relationship model is shown in Figure 11.

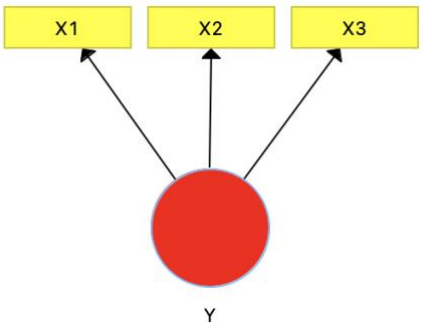

Figure 11. Reflexive Model Construct

Meanwhile, the formative relationship model is a composite variable that is determined by the indicator. The direction of the causality relationship appears from the indicator to the latent variable, and the characteristics of the formative relationship model are:

- The direction of the causality relationship from the manifest (indicator) to the latent variable (construct).
- Between indicators are assumed to be uncorrelated (no internal consistency test or Cronbach's Alpha is required).
- Omitting the indicator changes the meaning of the construction.
- Measurement error is put at the construct level (δ)

The unified form of the formative relationship model in SEM is called a formative construct. The construct is limited in terms of elements, features, and properties to be observed and measured. The relationship model is represented by X1, X2, and X3 as the manifest variable (indicator) while Y is a latent variable. The formative relationship model is shown in Figure 12.

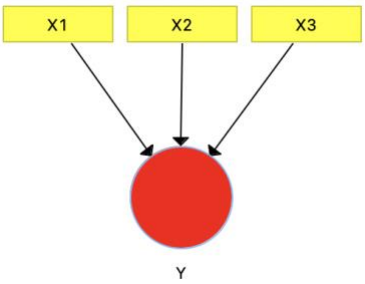

Figure 12. Formative Construct Model

2.5.2 Partial Least Squares (PLS)

Partial Least Square (PLS) is a method first introduced by Herman O.A. World. PLS is an alternative technique in SEM analysis where the multivariate data used are not normally distributed. In SEM with PLS, the value of the latent variable is estimated according to the linear combination of the manifest variable associated with the latent. It is treated to replace the manifest variable. The advantages of SEM with PLS is advantageous when compared to covariance-based SEM because it can handle two conditions, including:

1. Undetermined factor (uncertainty factor).

   The undetermined factor is when the resulting factor scores have different values when calculated from a single factor model. No common factor is always needed to be a combination of latent variables in the form of units, especially for the formative indicator. In this case, a latent variable is a

form of the linear combination of these indicators.

2. Unacceptable solution (unacceptable solution)

Unacceptable solution conditions will not occur in SEM with PLS because it is based on variance and not covariance since the singularity matrix problem will never occur. In addition, PLS works on a recursive structural model, since unidentified, under-identified, or over-identified problems will never occur.

Therefore, PLS is an approach to SEM without assuming data distribution, and can be a solution in small sample sizes since the application used to analyze has little theory.

2.6 Hypotheses Development

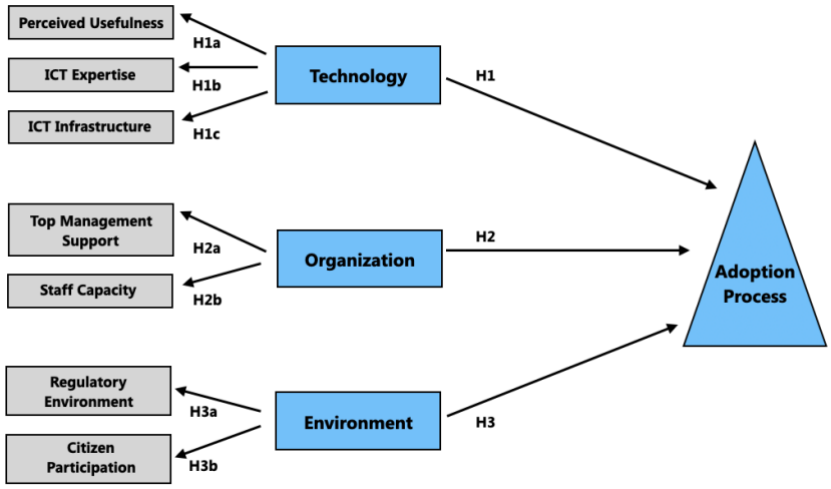

Figure 13. Hypotheses model development

2.6.1 Technology

Technological factors are all internal and external technologies related to the company or organization influencing technology adoption (Tornatzky, L. & Fleischer, 1990). Internal technology determines the limits of the ability of the

company or organization to face a change in innovation (Collins et al., 1988). Similarly, external technology measures the capabilities needed by a company or organization to adopt an innovation or technology higher than the existing one. Technological factors include knowledge as well as processes for developing and adopting new technologies. Therefore, the argument above leads to the following hypothesis:

H1: Technological Factors have a significant effect on Intention to Adopt AI-Based public Service (Chatbot Platform)

2.6.1.1 Perceived Usefulness

The perceived usefulness of a technology is often used as a benchmark and basic model as a suggestion to become a technology-related factor to influence the adoption of innovation (Jia et al., 2017). This is because of the motive that using this technology can improve performance (Davis, 1989). Several previous studies have also used the perceived usefulness variable to evaluate readiness from a technology side, such as online travel services (Yuan et al., 2016), mobile instant messaging (Victory Gloria & Achyar, 2016), and Enterprise 2.0 post-adoption (Jia et al., 2017). Therefore, the argument above leads to the following hypothesis:

H1a: Perceived usefulness positively contributes to Technological factors.

2.6.1.2 ICT Expertise

The variable of ICT expertise is indispensable in the process of developing, refining, and adjusting the organizational technology needs (B. W. Pudjianto & Hangjung, 2012). By having the ability, knowledge, and skills, organizations adopt and implement innovations more quickly 2021/7/14. Several studies also

explain that organizations with human resources with the ability, knowledge, and expertise in the IT field have a positive chance to succeed in the adoption or implementation of innovation (B. Pudjianto et al., 2011). Therefore, the argument above leads to the following hypothesis:

H1b: ICT Expertise positively contributes to Technological factors.

2.6.1.3 ICT Infrastructure

ICT infrastructure supports developing technical knowledge and managerial skills, as well as optimizing the technology (Zhu et al., 2003). An ICT infrastructure collects physical resources that provide essential services to an entire organization (B. W. Pudjianto & Hangjung, 2012). Meanwhile, technology is not just a non-physical asset but needs to be balanced with the development of knowledge and expertise in physical assets, which will positively impact the adoption of an innovation. Therefore, the argument above leads to the following hypothesis:

H1c: ICT Infrastructure positively contributes to Technological factors.

2.6.2 Organization

Organizational factors influence the innovation adoption process (B. W. Pudjianto & Hangjung, 2012), and provide as well as manage all existing resources in the organization to support the innovation adoption process (Yang et al., 2015). Resources and all attributes in an organization are significant to measure innovation adoption readiness because these factors can support or hinder the adoption process (Aboelmaged, 2014). Furthermore, staff capacity and top management support are some of the many variables in organizational factors that play a significant role (Yang et al., 2015). Therefore, the argument

above leads to the following hypothesis:

H2: Organization factors significantly affect Intention to Adopt AI-Based public Service (Chatbot Platform).

2.6.2.1 Top Management Support

Top management support is very influential on the quality and behaviour of employees in the organization to provide motivation or support for adopting innovation. It is defined as a commitment to managerial trust to actively participate and initiate innovation in adoption 2021/7/14. Furthermore, resources within the organization can also be maximized effectively and efficiently with top management support (B. W. Pudjianto & Hangjung, 2012), which is one of the three critical factors in the innovation adoption process within the organization (Jeyaraj et al., 2006). A strong link between top management support and organizational decisions in adopting innovation produces significant and positive results. Therefore, the argument above leads to the following hypothesis:

H2a: Top Management Support positively contributes to organization factors.

2.6.2.2 Staff Capacity

It was explained above that top management support dramatically influences the behaviour and readiness of workers to adopt innovations. In the context of IT innovation adoption in the organizational dimension, there is two coverage of its capabilities consisting of resources and employees (Bharadwaj & Grover, 2016). The budget used to apply, maintain and develop IT is a variable measurement of the resources in the organization. Meanwhile,

measuring employees in the IT field will usually calculate the total number of capable employees and have expertise in installing, maintaining, developing, and solving IT-related problems. According to Kamal et al., 2006, organizations with sufficient IT skills and budgets are more likely to adopt innovations. Therefore, the argument above leads to the following hypothesis:

H2b: Staff Capacity positively contributes to organization factors.

2.6.3 Environment

The environment is the last context of the TOE framework. Environmental context is a collection of factors external to an organization that influences the innovation adoption process (Stenberg & Nilsson, 2020). It combines the dogmatic environment, industrial structure, and technology service providers' availability (Scupola, 2003) and has a significant influence on the readiness and ability of an organization to adopt innovation by combining several combinations of perspectives. Examples include pressure from high competition between competitors and market uncertainty will drive the innovation process faster.

On the contrary, regulatory boundaries become obstacles faced in the environmental context. Furthermore, support from all sectors such as government, society, the private sector, etc., is needed to impact and target positively. Therefore, the argument above leads to the following hypothesis:

H3: Environment factors significantly affect Intention to Adopt AI-Based public Service (Chatbot Platform).

2.6.3.1 Regulatory Environment

According to Zhu et al. (2003), The regulatory environment is an essential

factor in environmental dimensions that influence innovation adoption. In another study conducted by Zhu and Kraemer (2005), it was found that the adoption of innovation will be slow and likely to be unsuccessful due to the absence of government policy support that limits it. In implementing new technologies such as AI, IoT, and Big Data, government support in regulations and policies is needed to plan, regulate, develop and maintain the IT ecosystem. Furthermore, the regulatory environment also includes policies, laws, and regulations that should be implemented by all levels of the organization (B. W. Pudjianto & Hangjung, 2012). Therefore, the argument above leads to the following hypothesis:

H3a: Regulatory Environment positively contributes to environmental factors.

2.6.3.2 Citizen Participation

The vital factors for successful adoption of innovation, cooperation, and collaboration with externals include academics, consultants, citizens, the private sector, and the community (Hidayanto et al., 2018). Citizen participation is needed because the adoption of innovation or technology aims to improve the quality of life of many people. There are two types of approaches used in previous studies, namely, top-down (focus on technology) and bottom-up (focus on citizen participation) (Simonofski et al., 2019). Meanwhile, citizen participation should identify problems, needs, goals, and benefits of the government's innovations. Therefore, the argument above leads to the following hypothesis:

H3b: Citizen Participation positively contributes to environmental factors.

Chapter 3. Research Methodology

This study was conducted based on qualitative and quantitative approaches. The qualitative approaches are used to validate the proposed TOE framework model and also explain the current conditions. Furthermore, several interview sessions were conducted with experts and government officials directly involved in AI national strategy, smart city architecture, and e-government. Based on the output, a structural equation model (SEM) and hypotheses were developed to analyze the factors that influence the adoption of AI-based public services based on the Technology-Organization-Environment (TOE). Furthermore, a quantitative approach was conducted with a survey method to re-validate the model and find the relationship between each variable.

3.1 Qualitative approaches

The qualitative research approach utilizes data in narratives, detailed stories, expressions, and original language construction results from respondents or informants. The data can be obtained from the collection techniques in the form of in-depth interviews and observations. Qualitative approaches can be understood as the procedures that use descriptive data in written or spoken words from people and actors observed. This approach was conducted to explain and analyze phenomena, events, social dynamics, attitudes of belief, and the perception of a person or group of something obtained through the study subject. These subjects are usually obtained from participants or respondents, and interviews were conducted in a semi-structured manner to allow further exploration of the study questions. The general theme was to validate the proposed TOE framework model and current constraints in

adopting AI-based public services (the case of the Indonesian Covid-19 Chatbot service). There were three interview phases conducted, and the first is a question about the experience of the respondent. The second phase was related to the factors and variables that will be proposed while the last phase was related to implementing and overcoming AI-based public services in the Indonesian covid-19 chatbot service. Respondent sample selection was conducted by looking for organizations and experts directly involved and responsible for the national AI strategy, smart city architecture, and e-government. The role of each respondent is explained in table 4.

Table 4. The Subject Interviewed

Respondent	Affiliation	Role
1	Ministry of Communication and Informatic Technology	Director
2	Ministry of Communication and Informatic Technology	Policy Analyst
3	Agency for the Assessment and Application of Technology	AI Expert
4	Jakarta Smart City	Urban Planning and Data-Driven Expert

3.2 Quantitative approaches

Quantitative approaches focus on objective measurements, which are then analyzed using statistical or numerical methods from the data collected.

The process of collecting data from quantitative methods can be through questionnaires or surveys, and the results are often used to explain a phenomenon (Babbie, 2010). Furthermore, descriptive or experimental methods should be chosen before collecting, analyzing, and explaining the quantitative approach results. Descriptive methods are only measured once, consisting of hundreds or even thousands of samples to analyze good relationships between variables.

3.2.1 Population and Sample

The study object is the central government and local governments in Indonesia that have adopted or not adopted AI-based public services but have a desire or plan to adopt the concept. The number of samples is determined by non-probability sampling techniques of purposive and snowball sampling. The following criteria are determined since all the populations can not be sampled: (1) are civil servants or experts in the central or local government, (2) Understand AI-based public services (chatbot platforms), (3) have used and has plans to adopt AI-based public services. The snowball sampling technique is also used to overcome the difficulty of finding and contacting the samples determined. This technique starts with a small number of samples first and then develops based on the recommendations that have been filled in. The theory and the minimum number of samples used in PLS-SEM is ten times the number of hypotheses in the model (Hair et al., 2017). In this study, there are ten hypotheses, which means that the minimum sample required is 100 since the target of 189 samples obtained has met the requirements. The total number of central and local governments in Indonesia is shown in table 5.

Table 5. Number of Central and Local Governments

Government Type	Organization Type	Number
Central Government	Ministry/Department	34
	Agency	28
Local Government	Province	34
	Regency	416
	Municipality	98
Total		610

3.3 Data Collection

3.3.1 Survey

Before conducting the survey, interviews were conducted to collect data related to the object of the study. In quantitative methods, surveys are the method most often used. This is conducted through a questionnaire in the form of data collection, which is analyzed into helpful information. The questionnaire used five Likert scale answer options of strongly agree, agree, neutral, disagree, and strongly disagree (Robinson, 2014). The distribution was conducted online through the Typeform application given to respondents in April 2021. Based on the questionnaire data collection results distributed to almost all central and local governments, a total of 189 were filled perfectly. The existing questionnaire will be processed and analyzed to be declared valid and used in the data processing using the SmartPLS application.

3.3.2 Survey Instrument

In this survey instrument, there is a questionnaire that is divided into

two parts. The first section contains questions about the profile of respondents and general questions while the second contains study testing questions. 20 test questions have been adjusted to the variables in the TOE Framework model. The list of questions can be seen in Table 6, and the complete questionnaire format can be seen in the appendix section.

Table 6. Survey Instrument

No	Dimension	Variable	Indicator	Previous Study
1	Technology	***Perceived Usefulness*** The perceived usefulness of a technology is often used as a benchmark and basic model as a suggestion to become a technology-related factor to influence the adoption of innovation (Jia et al., 2017).	(1) Using a chatbot platform can improve the performance of the institution **(PU1)** (2) Using chatbot platform can speed up services to citizens **(PU2)** (3) Using chatbot platforms is very useful in reducing face to face in public services **(PU3)**	evaluate readiness from a technology side such as online travel services (Yuan, Lin, & Zhuo, 2016), mobile instant messaging (Gloria & Achyar, 2018), and Enterprise 2.0 post-adoption (Jia et al., 2017)
		ICT Expertise By having the ability, knowledge, and skills, organizations tend to adopt and implement innovations more quickly (Crook & *Kumar, 1998)*	(1) Our institution is supported by personnel who have particular expertise or knowledge in the field of ICT **(IE1)** (2) Our institution conducts benchmarking with other institutions to update knowledge in the field of ICT **(IE2)**	Determinant of E-government assimilation (B. Pudjianto et al., 2011)

		ICT Infrastructure ICT infrastructure provides support in developing technical knowledge, developing managerial skills, and also how to optimize the technology (Zhu et al., 2003)	(1) Utilizing the National Datacenter will have a positive impact on chatbot platform system **(II1)** (2) Increasing the internet speed will support the chatbot platform system **(II2)** (3) The broadband coverage in all regions of Indonesia can indirectly strengthen the ICT sector in terms of chatbot platform adoption **(II3)**	Determinant of E-government assimilation (B. Pudjianto et al., 2011)
2	Organization	***Top Management Support*** Commitment to managerial trust to actively participate and to initiate innovation in adoption (Chatterjee, 2002).	(1) Top management support the implementation of chatbot platform **(TMS1)** (2) Top management sets goals and standards in the implementation of the chatbot platform **(TMS2)** (3) Top management is willing to take the risks that result from implementing a chatbot platform	Determinant of E-government assimilation (B. Pudjianto et al., 2011), Understanding determinants of cloud computing adoption using an integrated TAM-TOE model (Helmata Gangwar et al., 2015)

			system **(TMS3)**	
		Staff Capacity IT innovation adoption in the organizational dimension, there is two coverage of IT capabilities consisting of IT resources and IT employees (Bharadwaj & Grover, 2016)	(1) Government employees understand about the chatbot platform system **(SC1)** (2) Government employees are trained to develop and maintain a chatbot platform system **(SC2)** (3) Institutions support the government employees to have skills certification **(SC3)**	Factors influencing readiness of adopting AI (Louise Stenberg et al., 2020)
3	Environment	***Regulatory Environment*** a critical factor in environmental dimensions that influence innovation adoption (Zhu et al.,2003).	(1) Government laws and regulations support the initiative and implementation of the chatbot platform **(RE1)** (2) The implementation of the chatbot platform in public services is included in the national priority **(RE2)**	Determinant of E-government assimilation (B. Pudjianto et al., 2011), Factors influencing readiness of adopting AI (Louise Stenberg et al., 2020)
		Citizen Participation collaboration with externals such as academics,	(1) The government involves the community, academia, expertise	Smart City Readiness Model based on Technology-Organization-Environment

		consultants, citizens, the private sector, and the community are some of the critical factors for successful adoption (Hidayanto et al., 2018).	related to service needs. **(CP1)** (2) The government provides knowledge to the public about how to use the chatbot platform system **(CP2)**	(TOE) Framework and Its Effect on Adoption Decision (Dewi Made Ayu et al., 2018), Influencing Factors of Public Participation in Meteorological Disaster Prevention and Mitigation (Changkai Wang et al., 2020
4	Intention To adoption AI-Based Public Services	***Intention to adoption***	(1) Overall, currently, our institution is interested in using the chatbot platform to improve services to the community **(IA1)** (2) Our institutions are interested in technological developments such as chatbot platforms to speed up bureaucratic processes and decision making in the next year **(IA2)**	Davis and Venkatesh (1996), Marakarandy, Yajnik, & Dasgupta (2017), Ducey (2013)

Chapter 4. Analysis and Results

This chapter describes the results of data analysis based on the research methods of Chapter 3, including the demographic data of respondents and an explanation of the processing results.

4.1 Demographic Data of Respondents

Respondents of this study included three criteria: (1) Civil servants or experts in the central or local government, (2) Understanding of AI-based public services (chatbot platforms), (3) having used and planning to adopt AI-based public services. Meanwhile, the questionnaire was distributed online and 189 respondents were obtained.

Furthermore, the demographics of 189 respondents will be explained, starting from the institution's origin and role, age, the number of public services, and the status of the institution concerning chatbot platform service implementation.

4.1.1 Origin of the institution

Of 189 respondents, 146 people (77%) came from the central government, and 43 (23%) came from local governments. This illustrates that the implementation of the chatbot platform service is mainly in the central government. The regional government, in this case, is only represented by four major cities on the island of Java that has implemented the smart city concept and provides chatbot platform services (Jakarta, Bandung, Semarang, and Surabaya). Meanwhile, the proportion diagram of the respondents based on the institution's origin can be seen in Figure 14.

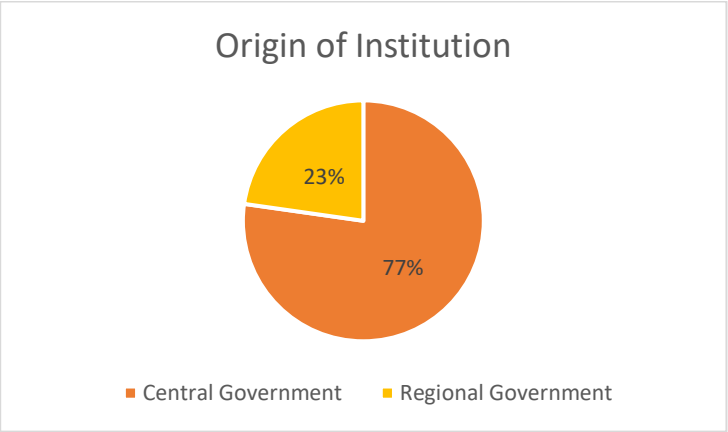

Figure 14. Respondents' description based on the origin of the institution

4.1.2 Role in the Institution

from the total 189 respondents, 108 people (57%) were technical staff as well as an expert in the field of ICT, 63 people (33%) were sub-coordinators in running government programs, 12 people (6%) were coordinators responsible for program success, five people (3%) were directors authorized to determine government policy, and one director-general (1%) responsible for all decisions and policies at the highest level under the minister. The proportion diagram of respondents based on the institution's origin can be seen in Figure 15.

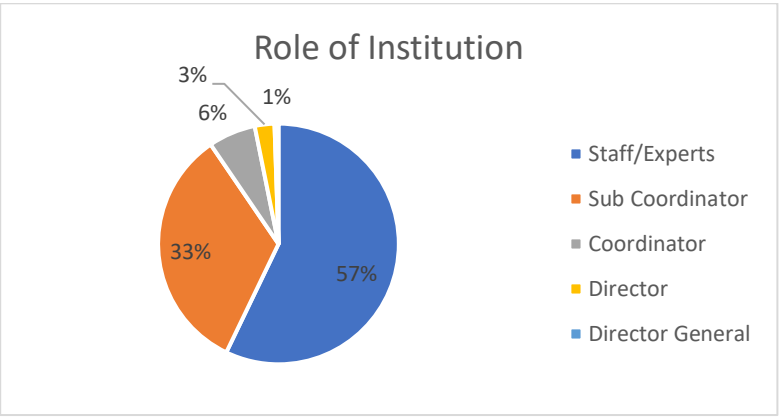

Figure 15. Respondents' description based on the role in the institution

4.1.3 Age

In Figure 16, from 189 respondents, 105 (55%) were in the 31-40 years age group. Then followed by the age group <30 years with 53 respondents (28%), the age group 41-50 years with 28 respondents (15%), and the age group > 51 years with 3 respondents (2%).

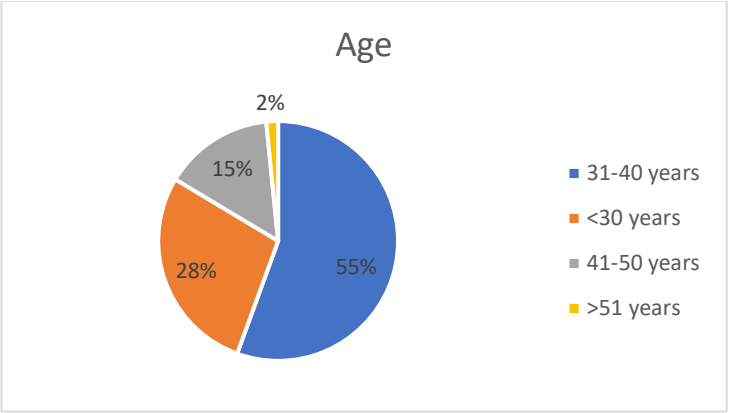

Figure 16. Respondents' description based on age

4.1.4 The number of public services under the institution

Out of a total of 189 respondents, 97 (51%) have less than five public services under the institution, then 49 (26%) have 6-10 public services, and 43 respondents (23%) have more than ten public services under the institution. The diagram of the proportion of respondents based on the origin of the number of public services available under the institution can be seen in Figure 17.

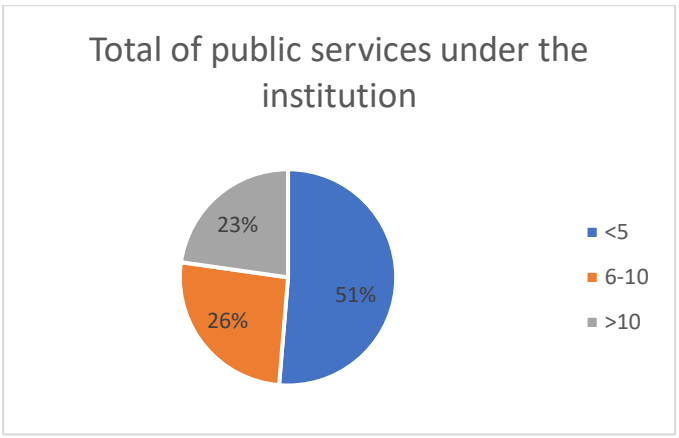

Figure 17. Respondents' description based on the number of public services under the institution

4.1.5 Status of AI-based public services implementation

In Figure 18, out of a total of 189 respondents, 111 (59%) understood and had used AI-based public services (chatbot platform system), then 55 (29%) stated that they had not implemented it. Furthermore, 23 respondents (12%) did not know whether the institution has implemented a chatbot platform or not.

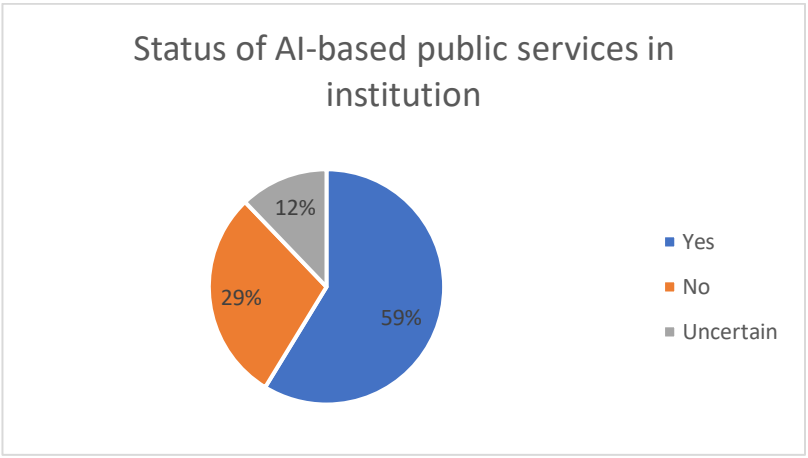

Figure 18. Respondents' description based on status AI-based public services implementation

4.1.6 Respondents Demographics Summary

Table 7 shows a summary of the respondents' demographics based on the institution's origin, role, age, the number of public services under the institution, and the status of chatbot platform service implementation.

Table 7. Respondents' demographic summary

Demographic Variables		Total
Origin of Institution	Central Government	146 (77%)
	Regional Government	43 (23%)
Role in the Institution	Staff/Experts	108 (57%)
	Sub Coordinator	63 (33%)
	Coordinator	12 (6%)
	Director	5 (3%)
	Director-General	1 (1%)
Age	<30 years	105 (55%)
	31-40 years	53 (28%)
	41-50 years	28 (15%)
	>51 years	3 (2%)
Number of public services under the institution	<5	97 (51%)
	6-10	49 (26%)
	>10	43 (23%)
Status of AI-based public services implementation	Yes	111 (59%)
	No	55 (29%)
	Uncertain	23 (12%)

4.2 Data Analysis using SEM Method Using SmartPLS 3.3.2

There are four stages in SmartPLS 3.0 to analyze data using the SEM method, including making path diagrams, evaluating measurement models, evaluating structural models, and conducting hypothesis testing.

4.2.1 Path diagram formation

The formation of the path diagram is adjusted to the model previously stated in chapter 2. It consists of 4 latent constructs used in the study model. The path diagram image can be seen in Figure 19.

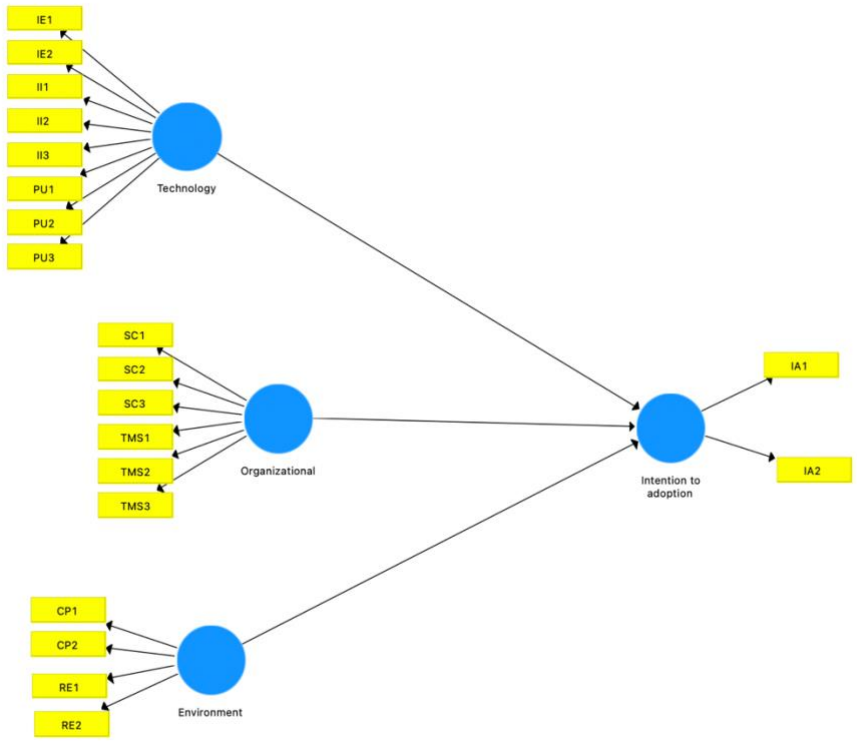

Figure 19. Path diagram of a research model

4.2.2 Evaluation of Measurement Model (Outer Model)

In the measurement model or outer model SEM-PLS, Convergent Validity examination analysis is conducted consisting of an individual item reliability test, internal consistency, Average Variance Extracted (AVE), and a Discriminant Validity examination.

4.2.2.1 The convergent validity examination analysis

Convergent validity (convergent validity) shows the variance between the indicator and its construct.

a. Loading factor examination

A valid indicator should have a loading factor greater than 0.7 on the construct (Hair et al., 2013), and table 8 shows the loading factor of each indicator in the initial model.

Table 8. Initial Outer Loadings Factor Results

Indicator	Intention to adoption	Environment	Organizational	Technology
IA1	0.923			
IA2	0.938			
CP1		0.708		
CP2		0.775		
RE1		0.846		
RE2		0.888		
SC1			0.813	
SC2			0.815	
SC3			0.765	
TMS1			0.483	
TMS2			0.816	
TMS3			0.758	
IE1				0.93
IE2				0.871
II1				0.77
II2				0.88
II3				0.819
PU1				0.741
PU2				0.756
PU3				0.834

The table shows that the TMS1 indicator has a loading factor value that does not meet the minimum value requirements, and it is removed

from the model. After removing TMS1, the next step is to test the loading factor again, and the results can be seen in Table 9.

Table 9. Outer Loadings Factor After Modification

Indicator	Intention to adoption	Environment	Organizational	Technology
IA1	0.923			
IA2	0.938			
CP1		0.708		
CP2		0.775		
RE1		0.846		
RE2		0.888		
SC1			0.809	
SC2			0.838	
SC3			0.788	
TMS2			0.798	
TMS3			0.751	
IE1				0.93
IE2				0.871
II1				0.77
II2				0.88
II3				0.819
PU1				0.741
PU2				0.756
PU3				0.834

b. Internal Consistency Reliability

At this stage, testing is conducted by looking at the composite reliability value. The threshold value used is 0.7 (Ghozali & Latan, 2015), and table 10 shows that the composite reliability value used has met the specified minimum threshold. It can be concluded that these variables can meet the requirements for use.

Table 10. Composite Reliability Results

	Composite Reliability
Intention to adoption	0.928
Environment	0.881
Organizational	0.897
Technology	0.945

c. Average Variance Extracted (AVE)

Testing at this stage is carried out by looking at the Average Variance Extracted (AVE) value. The AVE value for good convergent validity is indicated by a minimum of 0.5 (Hair et al., 2013). The results of the analysis test can be seen in table 11, where the value of all variables is more significant than 0.5. It can be concluded that the AVE value is acceptable and meets the requirements.

Table 11. Average Variance Extracted (AVE) Results

	Average Variance Extracted (AVE)
Intention to adoption	0.865
Environment	0.651
Organizational	0.636
Technology	0.685

d. Discriminant Validity

The discriminant validity test is conducted to evaluate the strong relationship of the indicators with its construct compared to others. This testing phase was conducted in two stages of checking the cross-loading value. The first stage is to check the cross-loading value by comparing the correlation of the indicator with its variables and other

block variables. The value between the indicators should be greater than the correlation with the variables in other blocks (Hair et al., 2013), and table 12 shows the cross-loading value.

Table 12. Cross-Loading Value

	Intention To Adoption	Environment	Organizational	Technology
IA1	0.923	0.599	0.702	0.581
IA2	0.938	0.73	0.74	0.61
CP1	0.48	0.708	0.414	0.4
CP2	0.537	0.775	0.437	0.37
RE1	0.624	0.846	0.606	0.45
RE2	0.658	0.888	0.628	0.535
SC1	0.584	0.462	0.809	0.489
SC2	0.733	0.627	0.838	0.585
SC3	0.639	0.629	0.788	0.573
TMS2	0.613	0.503	0.798	0.615
TMS3	0.482	0.333	0.751	0.494
IE1	0.592	0.506	0.647	0.93
IE2	0.598	0.52	0.633	0.871
II1	0.384	0.364	0.428	0.77
II2	0.468	0.346	0.583	0.88
II3	0.528	0.509	0.554	0.819
PU1	0.546	0.443	0.58	0.741
PU2	0.551	0.472	0.575	0.756
PU3	0.51	0.416	0.545	0.834

The second stage is checking the Fornell-lacker criterion, which is conducted by looking at the root value of the AVE. The value should be greater than the correlation between constructs and others (Hair et al., 2013). Table 13 shows that the value of the AVE root is greater than the correlation between constructs and other constructs.

Table 13. The results of the Fornell-Lacker score

	Environment	Intention to adoption	Organizational	Technology
Environment	0.807			
Intention to adoption	0.718	0.93		
Organizational	0.656	0.776	0.797	
Technology	0.548	0.64	0.695	0.827

Based on the measurement model analysis (outer model), the four tests conducted met the existing standards. Therefore, the model used has been proven to have met the good characteristics at each test stage. The results of the measurements can be seen in the appendix.

4.2.3 Evaluation of Structural Model

The structural model analysis is divided into six stages of testing the path coefficients, coefficient of determinant (R^2), t-test using the bootstrapping method, and effect size (f^2). The following is an explanation of each test conducted:

4.2.3.1 Path Coefficients

Path coefficients were tested to obtain the significance between latent constructs. The path coefficients were considered insignificant when they were in the range of -0.1 to 0.1. Table 14 and figure 20 show the path coefficient for each construct.

Table 14. Path Coefficient on each construct relationship

the relationship between variables	β

Environment -> Intention to adoption	0.345
Organizational -> Intention to adoption	0.456
Technology -> Intention to adoption	0.134

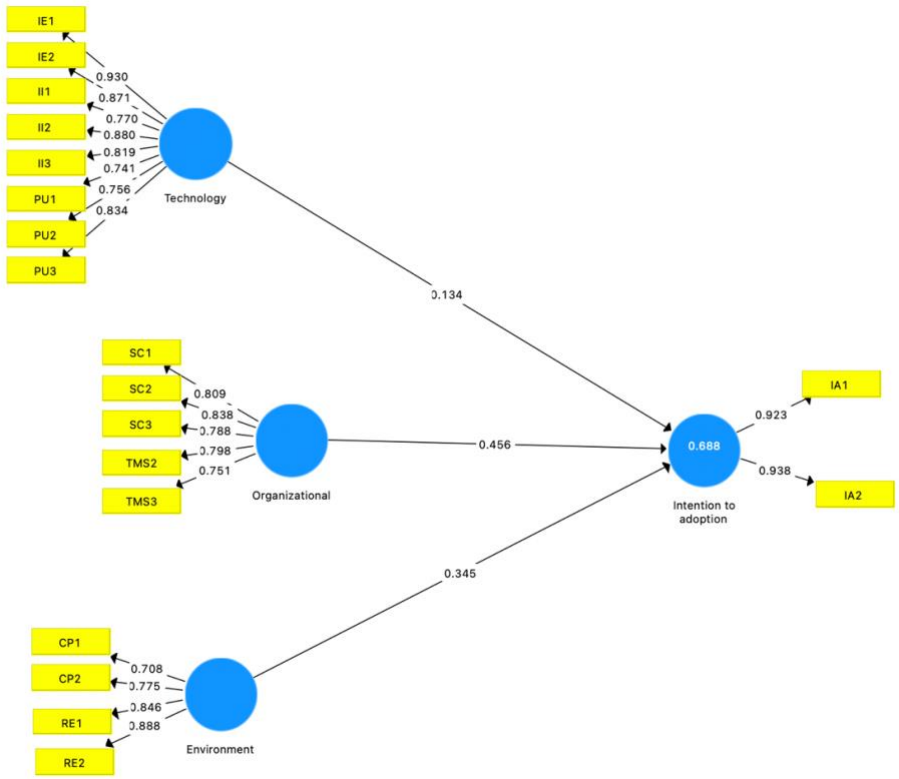

Figure 20. Path Coefficient results

4.2.3.2 Coefficients of Determinant (R^2)

The coefficient of determination is the R^2 calculated test for endogenous constructs. There are three R^2values, namely 0.75, 0.50, and 0.25 (Hair et al., 2013). R^2 valued close to 0.75 is in the substantial category, R^2 valued at close to 0.50 is in the moderate category, and R^2valued close to 0.25 is in a

low category. Table 15 shows that the influence of technology, organizational and environmental variables on intention to adoption is 0.688 or 68.8%.

Table 15. Coefficient of Determinant result

	R Square	Category
Intention to adoption	0.688	Substantial

4.2.3.3 Hypothesis test

Hypothesis testing is conducted to see the acceptance of the hypothesis proposed. Furthermore, the testing is conducted using the bootstrapping method with the one-tailed test where the significant level used is 5%. Based on this, a valid t-test value is obtained when it is more significant than 1.96 (Hair et al., 2013). As shown in Table 16 and Figure 21, it is known that all hypotheses are accepted.

Table 16. T-test result

	Hypothesis	Path Coefficient	T Statistics	Test result
H3	Environment -> Intention to adoption	0.345	5.97	Accepted
H2	Organizational -> Intention to adoption	0.456	6.019	Accepted
H1	Technology -> Intention to adoption	0.134	2.559	Accepted
H3b	CP1 <- Environment	0.708	16.191	Accepted
	CP2 <- Environment	0.775	20.802	
H3a	RE1 <- Environment	0.846	36.322	Accepted
	RE2 <- Environment	0.888	52.737	
H2b	SC1 <- Organizational	0.809	21.319	Accepted
	SC2 <- Organizational	0.838	47.733	
	SC3 <- Organizational	0.788	24.275	
H2a	TMS2 <- Organizational	0.798	24.467	Accepted
	TMS3 <- Organizational	0.751	15.739	
H1b	IE1 <- Technology	0.93	76.228	Accepted

	IE2 <- Technology	0.871	26.103	
H1c	II1 <- Technology	0.77	16.928	Accepted
	II2 <- Technology	0.88	32.852	
	II3 <- Technology	0.819	22.229	
H1a	PU1 <- Technology	0.741	19.312	Accepted
	PU2 <- Technology	0.756	20.888	
	PU3 <- Technology	0.834	22.872	

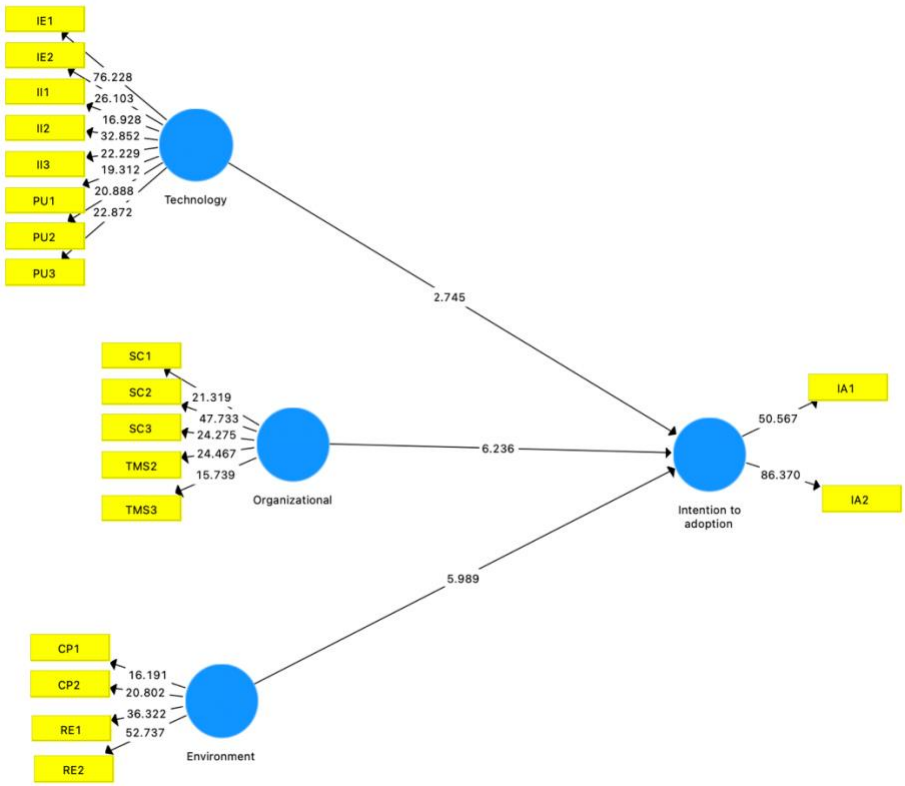

Figure 21. T-test value

4.2.3.4 Effect Size (f^2)

This testing stage is carried out by calculating the size value to predict the effect of a specific variable on others in the structural model. The effect size value, which has a limit of around 0.02, means a low affect, 0.15 means a medium effect, and 0.35 means a high effect. Meanwhile, the effect size value below 0.02 means that it does not influence the structural model (Hair et al.,

2013). The results of the calculation of the effect size value can be seen in table 17.

Table 17. Table Effect Size (f^2)

Hypothesis		f^2	Influence
Hypothesis	Path		
H1	Technology -> Intention to adoption	0.029	Low
H2	Organization -> Intention to adoption	0.273	Medium
H3	Environment -> Intention to adoption	0.211	Medium

Based on table 17, it is known that the Organization → Intention to Adoption hypothesis has a significant effect close to 3.0. The environment → Intention to Adoption has a moderate effect around 2.0. Therefore, the two hypotheses have a moderate effect on the structure of the model. Meanwhile, technology → Organization with a value of 0.2 has a negligible effect on the structural model.

4.3 Discussion of Analysis Results

This study aims to determine the factors that influence adopting a chatbot platform in Indonesia through technological, organizational, and environmental approaches. The results can also determine in what aspects the Indonesian government should focus on adopting AI-based public services. Furthermore, data analysis was performed using the PLS-SEM method. Based on the results of data analysis, ten hypotheses were proposed, and after analysis, the ten hypotheses were accepted. From the analysis results, it is known that organizational factors have a tremendous influence on the intention to adopt AI-based public services, followed by environmental factors.

The technology factor only has a negligible effect on the adoption of AI-

based public services. Meanwhile, the staff capacity, regulatory environment, and ICT expertise have high values that positively contribute to each of the dimensions represented. Table 18 illustrates the comparison of the results with previous studies, and the comparison of each hypothesis's discussion will be described as follows.

Table 18. Result comparison with the previous study

No	Topic	Author	Indicator	Result
1.	Determinants of e-government Assimilation in Indonesia: an empirical investigation using a TOE framework	Pudjianto & Hangjung (2012)	ICT Expertise, ICT Infrastructure, Top Management Support Organizational, Compatibility, Extend of coordination, Regulatory environment, Competitive environment	• This study provided seven hypotheses, and two were rejected, namely organizational compatibility and extension of coordination. • ICT infrastructure has the most substantial relationship with e-gov assimilation. It will support top management in the Organizational to

				make e-gov programs work properly. Government should focus on developing ICT infrastructure in the public sector to building e-gov systems. • ICT Infrastructure, Expertise, and regulatory environment are more important in regional governments than in the central. ICT infrastructure is the primary concern for e-gov assimilation. Insufficient ICT expertise also

				indicates the lack of talented human resources. Central government tends to have advantages over the regional since ICT infrastructures and expertise are more available. The regulatory environment also has a significant impact on regional governments rather than on central. These findings confirm that attention is needed when analyzing and stipulating different policies on e-gov assimilation in

				central and regional governments.
2.	What drives consumer knowledge sharing in online travel communities?: Personal attributes or e-service factors?	Yuan, Lin, & Zhuo (2016)	Innovativeness, Subjective knowledge, Perceived ease of use, Perceived usefulness.	• Innovation has a significant direct effect and a total effect on knowledge sharing through subjective knowledge, therefore confirming that subjective knowledge performs a partial mediating role between innovation and knowledge sharing, supporting the perceived ease of use having a significant total effect on

				knowledge sharing. • "Perceived ease of use" and "perceived usefulness" of airline e-services predict knowledge sharing in the online consumption community with "perceived usefulness" performing a partial mediating role.
3.	Enterprise 2.0 post-adoption: Extending the information system continuance model based on the	Jia et al. (2017)	Perceived usefulness, Firm sizes, Firm scope, Subjective Norms, Competitive Pressure	• This study provided nine hypotheses, and two were rejected, namely firm sizes and firm scopes that are not positively

	technology-Organization-environment framework			associated with the firm's E2.0 continuance intention. • Subjective norms were more important drivers than perceived satisfaction and usefulness in the context of non-individual IS continuity use.
4.	Factor affecting hotels' adoption of mobile hotel reservation systems: A technology-organization-environment	Yi-Sung Wang, Hsien-Ta Li, Ci-Rong Li, Ding-Zhong Zhang (2016)	Relative advantage, Complexity, Compatibility, Top Management Support, Firm Size, Technological Competence, Competitive	• This study provides nine hypotheses, where four were rejected, namely relative advantage, top management support, competitive pressure, and intensity. They have no positive

			Pressure, Critical Mass, Information Intensity	effect on the adoption of the Mobile Hotel Reservation System.
5.	Factors Influencing readiness adopting AI: Sweden case	Stenberg et al. (2020)	Relative advantage, Compatibility, Management Support, Staff Capacity, AI Ethics, Regulatory Environment, Competitive Pressure	• This study using qualitative data collection. • The organizations that have started their AI journey have seen the technologies as a potential solution. The needs of these organizations have been guiding when AI is the right technology, in other words evaluating the relative advantage. Similarly, compatibility is an

				influential factor because it dramatically impacts development and maintenance processes even though its importance is not vital as other factors depending on how far an organization has gotten on its AI journey. • Staff capacity in the organizational dimension is a complex and multifaceted factor since it covers recruiting talents and enhancing knowledge for

				current employees and covers both AI developers and end-users without computer science skills.
6.	Understanding determinants of cloud computing adoption using an integrated TAM-TOE model	Helmata Gangwar et al., 2015	Relative advantage, Compatibility, Complexity, organizational readiness, training & education, Top Management Support, Competitive Pressure, Trading Partner Pressure	• Ease of use, relative advantages, compatibility, complexity, organizational readiness, training and education, top management commitment, competitiveness pressure of trading partners, security, factors associated with service providers influence cloud computing

				adoption intentions. • Relative advantage does not affect direct adoption intention; This indicator indirectly affects the benefits and perceived ease of use. Adoption intentions in the context of technology depend on the benefits of its usefulness. • Top management support was found to have an immediate effect on cloud computing

				adoption intentions as well as an indirect effect through perceived ease of use and benefits within the organization. Management is willing to take risks associated with cloud computing implementations.
7.	Smart City Readiness Model based on Technology-Organization-Environment (TOE) Framework and Its Effect	Dewi Made Ayu et al., 2018	Instrumentation and control, Connectivity, Interoperability, Data Management and Analytics, Privacy and security, IT Professional	• This study provides fourteen hypotheses, where three were rejected: interoperability, privacy and security, and Citizen computer and internet

	on Adoption Decision		Support, Top management support, Viable Funding Strategy, Citizen computer and internet technology self-efficiency, Citizen's engagement and participation, partnership and collaboration.	technology self-efficiency. • The Internal organizational readiness and readiness for collaboration with external parties are the most significant factors influencing the government's intention to adopt the smart city concept and utilize technology to support smart city implementation. • The availability of IT professionals, full support and commitment from the leadership,

				and the right funding strategy are essential factors that will influence adoption decisions in an organizational context. Furthermore, this study explains the problems faced by local governments related to funds and limited human resources that understand IT since smart city adoption is delayed or even not implemented at all.

4.3.1 Relationship between Perceived usefulness, ICT Expertise, and ICT Infrastructure with technological dimensions.

H1a: Perceived usefulness positively contributes to Technological factors

H1b: ICT Expertise positively contributes to Technological factors

H1c: ICT Infrastructure positively contributes to Technological factors

The test of the contribution relationship between Perceived usefulness, ICT Expertise, and Infrastructure with the dimensions of technology gives the value of the path coefficient variable perceived usefulness 1 (PU1) 0.741; variable perceived usefulness 2 (PU2) 0.756; variable perceived usefulness 3 (PU3) 0,834, Variable ICT Expertise 1 (IE1) 0.930; variable ICT Expertise 2 (IE2) 0.871. Variable ICT Infrastructure 1 (II1) 0.770; variable ICT Infrastructure 2 (II2) 0.880; variable ICT Infrastructure 3 (II3) 0.819 respectively. All path coefficients are positive, therefore, hypotheses H1a, H1b, and H1c are accepted. Each variable positively contributes to Technological factors.

Variable ICT expertise 1 with a path coefficient value of 0.930 positively affects the technology dimension. The implementation of AI-based public services needs to be supported by experts that have unique expertise or knowledge in artificial intelligence to provide support and continuously improve the needs of constantly evolving technology. This is also in line with a previous study by Pudjianto & Hangjung (2012), which explains that ICT Expertise is a significant factor in technology development and implementation, especially in local governments that lack resources and knowledge. In the demographic results presented, almost 80% of respondents come from the

central government. Furthermore, only 20% of local governments implemented the smart city concept, since they are familiar with artificial intelligence systems. This has become a concern and has also become one of the problems identified at launching the first covid-19 chatbot services. The unequal expertise and knowledge in the chatbot field results in less-than-optimal results and does not meet the target in implementing covid-19 chatbot services. Therefore, with a total population of 250 million people, only less than 1% use this service. Secondary data obtained from interviews with the person directly related to this system explains that the lack of knowledge, targets, expertise, and unclear development concepts is an obstacle to the successful implementation of covid-19 chatbot services.

Perceived Usefulness and ICT Infrastructure also positively affect technology dimensions, but the effect is not significant enough to intention adoption. Furthermore, ICT Infrastructure in the central government tends to be more prepared to implement new technologies such as artificial intelligence in public services. With the equalization of ICT infrastructure in the central and regional governments, the artificial intelligence system will help complete tasks faster, increase productivity, and improve public services to the community. This is consistent with the study analysis results by Oghuma et al. (2015), which explains that perceived usefulness will be positive when the impact resulting from implementation is helpful for work and life.

4.3.2 Relationship between Top Management Support and Staff Capacity with Organizational dimensions.

H2a: Top Management Support positively contributes to Organizational factors

H2b: Staff Capacity positively contributes to Organizational factors

The test of the contribution relationship between Top Management Support and Staff Capacity with the organizational dimension gives the value of the path coefficient variable Top Management Support 2 (TMS2) 0.798; variable Top Management Support 3 (TMS 3) 0.751. Variable Staff Capacity 1 (SC1) 0.809; variable Staff Capacity 2 (SC2) 0.838; variable Staff Capacity 3 (SC3) 0.788 respectively. All path coefficients are positive, therefore, hypotheses H2a and H2b are accepted, and each variable positively contributes to Organizational factors.

The variable Staff Capacity 2 with a path coefficient value of 0.838 has the most positive effect on the organizational dimension. In line with the positive results on the variable staff capacity, according to Scaccia et al. (2015), Staff with general skills, education, and expertise in particular fields determine the Intention to adopt New Innovation. Furthermore, a study conducted by Pumplun et al. (2019) explains that staff with an understanding and programming capability of artificial intelligence of the organization is needed. Variable Staff Capacity 2 explained that government employees were trained to develop and maintain the artificial intelligence system (chatbot platform). With the training, it is expected that the central and regional governments have employees with the ability and skills to support the success of the application of innovation. Currently, there are huge gaps related to the capacity of staff in the central and regional governments. The regional government feels a lack of support from staff that understands and has the ability in artificial intelligence to be an obstacle in the implementation of innovation.

Meanwhile, the average staff knows artificial intelligence in the

central government but not an expert in the programming language algorithm. In implementing the Covid-19 Chatbot Services only until the stage of making the systems. Government employees do not clearly understand how to manage, maintain and also develop the system. Secondary data is also supported by interviews conducted with the person directly related to Covid-19 Chatbot Service. Government employees do not fully understand business processes and key performance indicators in implementing the chatbot services. Constraints in updating information and systems are obstacles found in this implementation. Therefore, the Indonesian government should focus on preparing and providing training to employees, especially in the development of AI-Based Public Services.

The top management support variable also positively impacts the organizational dimension after the staff capacity variable. Support from top management is also an essential factor in determining the intention to adopt innovations in the organization. Meanwhile, Pudjianto and Hangjung's (2012) research explains that solid support from top management will improve organizational performance and provide better service to the community. In the understanding of determinants of cloud computing adoption using an integrated TAM-TOE model study by Helmata Gangwar et al. (2015), the support also has a direct and indirect effect through perceived ease and usefulness within the organization. Furthermore, Top management is willing to take risks associated with cloud computing implementations.

4.3.3 Relationship between Regulatory Environment and Citizen Participation with environment dimensions.

H3a: Regulatory Environment positively contributes to Environment factors

H3b: Citizen Participation positively contributes to Environment factors

The test of the contribution relationship between regulatory environment and citizen participation with the dimension gives the value of the path coefficient variable Regulatory Environment 1 (RE1) 0.846; variable Regulatory Environment 2 (RE2) 0.888. Variable Citizen Participation 1 (CP1) 0.708; variable Citizen Participation 2 (CP2) 0.775. All path coefficients are positive respectively. Therefore, hypotheses H3a and H3b are accepted since each variable positively contributes to Environment factors.

Regulatory environment 2 describes making a national artificial intelligence strategy by the Research Agency and implementing artificial intelligence technology. It is one of the national priorities that significantly influences the environmental dimension. This result is also in line with the study conducted by Pudjianto and Hangjung (2012) and Zhu et al. (2003), which explains that the legal and regulatory framework is critical to support the implementation or adoption of an innovation. All initiatives and decision-making should be supported by regulations made by the government since the basics for developing, implementing, and adopting innovations will be more substantial. This is also supported by secondary data from interviews conducted with decision-makers from related Ministries and Agencies, which explain that regulation is the most critical factor before implementing innovation in public services. Furthermore, the Indonesian government should look at existing business processes and see the need for the importance of implementing the system.

Citizen participation is also contributing positively to the

environmental dimension. Regarding adopting AI-based public services, the government should collaborate with the private sector, the community, and academics. This is in line with the results of a study conducted by Hidayanto (2018) and Achaerandio et al. (2012) that working with external parties will provide positive input related to users' needs and understand the extent of community knowledge as well as skills in using the system. Even though the artificial intelligence system is currently still new and its use is still very minimal, the adoption of AI-based public services can be successful when the community plays an active role in its implementation. Furthermore, the government can provide socialization and training before or after implementation. The results showed that regulatory factors should be primarily considered by the Indonesian government in the intention to adopt AI-Based public services and that of citizen participation.

4.3.4 Relationship between Technology dimension with Intention to adoption

H1: Technological Factor has a significant effect on Intention to Adopt AI-Based Public Service (Chatbot Platform)

The structural analysis of the model on the t-test shows that H1 is accepted, therefore technological factors affect the intention to adopt innovation. In addition, the path coefficient value of 0.134 indicates that the technology hypothesis → Intention to adoption has a significant relationship but has a negligible effect when referring to the effect size (f2). Also, the technological factor has a significant but not strong enough influence on adopting an innovation. As explained in the relationship between each variable in the technology dimension, ICT expertise is the most positive indicator in the

technology dimension, which has a significant but less impact on adopting innovations in the following year. These results are consistent with previous studies by Pudjianto & Hangjung (2012), Crook & Kumar (1998), Lin & Lee (2005). This occurred because the Indonesian government has been supported by an expert in artificial intelligence that can provide trust and support to improve the ever-evolving technological needs, but only limited to theoretical. Practically, the Indonesian government will focus more on developing AI-based public services from an organizational and environmental perspective.

4.3.5 Relationship between Organizational dimension with Intention to adoption

H2: Organizational Factors has a significant effect on Intention to Adopt AI-Based Public Service (Chatbot Platform)

The structural analysis of the model in the t-test shows that H2 is accepted, therefore, the organizational factors affect the intention to adopt innovation. In addition, the path coefficient value of 0.456 indicates that the organizational hypothesis → Intention to adoption has a significant relationship and has a large effect when referring to the effect size (f2). Furthermore, the organizational factors have a significant and high influence on the intention to adopt innovation. As explained in the relationship between each variable indicator in the dimension, staff capacity is the most positively influential indicator. It has a very significant effect on the intention to adopt innovation next year. These results are consistent with previous studies by Kamal et al. (2006) and Stenberg et al. (2020). Currently, the Indonesian government is focusing on developing the capacity of employees in the central and local

governments. Various kinds of certification and training, especially in the field of artificial intelligence, will be given by the government this year. The target is that next year, or before moving to a new capital city in 2024, the government can adopt or implement AI-based in public services as directed by the President. This is also supported by secondary data from interviews with decision-makers in the central government.

4.3.6 Relationship between Environment dimension with Intention to adoption

H3: Environment Factors has a significant effect on Intention to Adopt AI-Based Public Service (Chatbot Platform)

The structural analysis of the model on the t-test shows that H3 is accepted, therefore, the environmental factors affect the intention to adopt innovation. In addition, the path coefficient value of 0.345 indicates that the environmental hypothesis → Intention to adoption has a significant and moderate effect when referring to the effect size (f2). Also, environmental factors have a significant and moderate effect on adopting an innovation. As explained in the relationship between each variable indicator in the environmental dimension, the regulation is the most positive indicator. It has a very significant effect on the intention to adopt innovation next year. These results are consistent with previous studies by Zhu et al. (2003), Pumplun et al. (2019), B.W. Pudjianto & Hangjung, (2012), Hart & Saunders (1997). In addition to developing employee capacity, the Indonesian government, through the Agency for the Assessment and Application of Technology and related ministries, is preparing a master plan and roadmap for the National AI Strategy to apply artificial intelligence. The AI strategy is based on the experience of

countries that have successfully implemented it and also some literature related to artificial intelligence in government. Furthermore, interviews were conducted with parties involved in the preparation of regulations. For its implementation, the Environmental Dimension was in the form of regulatory support from the government that regulates data integration between ministries/agencies. This regulation will become the basis for the development of artificial intelligence in public services and become a national priority.

4.4 Implication

This section describes the theoretical and practical implications of this study.

4.4.1 Theoretical Implication

The theoretical implications are as follows.

1. The findings imply that the technology dimension has a significant relationship but has a negligible effect compared to the organizational and environmental dimensions, which also have a significant and moderate effect on the intention to adopt an innovation. This is consistent with a previous study conducted by Pudjianto & Hangjung (2012) in assimilating e-government. Indicators of ICT expertise have the most positive contribution in the technological dimension and are less influential in the intention to adopt. In comparison, staff capacity in government and regulatory environment is the most positive indicator for the organizational and environmental dimensions, both of which have a moderate effect on adopting an innovation.
2. This study provides a reference with a multidimensional construct. The construct of the Intention to adopt (IA), is second-order and formative.

Construction Technology, Organization, and Environment is the reflective first order. All first-order constructs are functions that construct second-order.

4.4.2 Practical Implication

By knowing the factors influencing the intention to adopt innovation, this study can optimize the strategy in adopting artificial intelligence in public services. The discussion is as follows.

1. The government should strengthen human resources/staff capacity by providing training and certification of expertise in emerging technology fields such as robotic, artificial intelligence, the Internet of things, and others. Meanwhile, benchmarking with countries that have been successful in adoption and implementation is also essential to get an authentic experience in adopting innovation. This is consistent with the results of interviews conducted, explaining that the lack of expertise and ability of civil servants in developing AI-based (chatbot platforms) is an obstacle in the implementation of the chatbot platform.
2. In terms of regulations and policies, the government should clearly explain the stages to be conducted and targets to be achieved. According to the results of interviews that have been conducted, there is no key performance indicator as a measure of the covid-19 chatbot platform. Therefore, the system runs without a clear purpose.
3. In addition, the focus should be centered on the local governments by providing clear policies and regulations. Data integration between ministries/agencies/agencies should be conducted before adopting an

artificial intelligence system in public services, which is expected to be completed before moving to the new capital city.

4. The government can leverage the enormous population of Internet users as the most extensive digital economy market in Southeast Asia for Indonesian start-ups.
5. The government needs to provide a data-sharing system for artificial intelligence study and experimentation originating from the Indonesian One Data regulation, which already meets network security and data information standards and is managed professionally.
6. The government can collaborate with universities or research institutions to conduct the study and development of artificial intelligence innovations in preparation for the implementation of AI-based public services.
7. The government should identify the needs and priority scale in implementing artificial intelligence systems in public services to avoid duplication of budgets and systems.

Chapter 5. Conclusion and Limitation

This chapter describes the results based on the analyzed data in Chapter 4, including discussion, limitations, and future study.

5.1 Discussion

The main objective is to analyze the influential factor on the implementation of AI-Based public services in the Indonesian government. Using the technology, organizational, and environment (TOE) framework, this study provides several indicators to measure the relationship between the dimension and the Intention to adopt AI-Based public services (Chatbot Platform). The indicators were proposed to determine their relationship with the study objectives. According to the results of the analysis in chapter 4, the conclusions are as follows:

1. Based on the result from the questioner, 70% of respondents are from the central government. This is because there was a massive gap between the central and local governments related to technology equity. From the data obtained, the implementation of AI-based public services (chatbot platforms) is dominated by the central government, which has budget and infrastructure technology support, as well as human resource expertise. Regional governments are represented by regions that have implemented the smart city concept in their cities, such as Jakarta, Bandung, Surabaya, and Banyuwangi. Meanwhile, other cities are waiting for direction and support from the central government in implementing AI-based public services.
2. Staff capacity in the organizational dimension and regulatory

environment is the most influential factors to adopt AI-Based public services. Meanwhile, the technology dimension is also influential but has a negligible effect on the intention to adopt AI-based public services. From a previous study in e-gov assimilation by Pudjianto 2012, ICT infrastructure has the most vital factor required. The data from MCIT showed that $28 million/year is spent to develop the e-gov ecosystem (ICT sector). About 2,700 data centers spread over 630 central and regional governments to support the public sector. The interviews conducted showed that the Indonesian government has been supported by an expert from the university and private sector in artificial intelligence. This can provide trust and support to improve and adapt to the ever-evolving technological needs, but only limited to theoretical. Practically, the Indonesian government should focus more on developing AI-based public services from an organizational and environmental perspective. Therefore, the technology dimension has a negligible effect on the intention to adopt. Also, the explanation reinforces from interview respondents that Indonesia currently has a good network and internet as well as an increase in the provision of infrastructure and connectivity. However, that is not enough to generate interest in adopting artificial intelligence technology.

3. Staff capacity and regulatory environment also represented why implementation of the Covid-19 chatbot far from expected. Only 1% of users out of 250 million total population used this system. Based on an interview, the lack of employees with experience in developing and

maintaining AI systems is one of the problems the system cannot fit with citizen needed. The Indonesian government should provide certification and training for civil servants, especially in artificial intelligence. This initiative also supports the plan to implement AI-based public services before moving to the new capital in 2024.

4. From the interviews, the Indonesian government can recruit talent in artificial intelligence for skilled workers that will develop and operate artificial intelligence in national priority sectors and prepare the education programs in all formal and non-formal education institutions.
5. The regulatory environment is also one of the most significant indicators in intention to adopt AI-based public services. The Indonesian government should focus on how to make regulations about data integration between institutions or ministries. This regulation will become the basis for developing AI-based public services and become a national priority. The Indonesian government should have a supervisory agency to oversees and controls the development and utilization of artificial intelligence in society, as described in the national artificial intelligence strategy.
6. Based on our interview, the legal context in terms of the forms of regulation governing Artificial Intelligence is divided into the following:
    a. Regulations control the specifics of Artificial Intelligence technology. (Automated decision making, face recognition).

b. Regulations that specifically control the application of technology or the application of technology in the business sector. (Financial, health, human resource management)
c. Legal liability for unintentional consequences of the use of Artificial Intelligence. (Criminal, civil)
d. A code of ethics that is made voluntarily either by associations of Artificial Intelligence business actors or particular groups.

7. From the results of the analysis and interviews conducted, there are strengths and weaknesses in the Indonesian government in adopting AI-based public services. The strengths are:
    a. Adequate Telecommunication Network and Internet for cloud computing services.
    b. Increasing National Infrastructure and Connectivity Development throughout the archipelago.
    c. The government provides incentive funds for programs as a result of industrial collaboration with universities or with a government research institute

    , and the weaknesses include:
    a. Implementation of the One Data Indonesia Regulation is still facing a silo or ego-sectoral attitude.
    b. Network security systems and data information that is still easy to hack.
    c. There is still a tiny amount of study and development of artificial intelligence innovations conducted by industrial

collaborations and universities or research institutes.

d. Indonesian people have not been well educated by the knowledge and learning of artificial intelligence.

e. There are still a small number of Indonesian experts, lecturers, and professors in artificial intelligence.

5.2 Model Comparison

The two studies with the topic of determinants concerning assimilation of e-government: an empirical investigation using the TOE framework by Pudjianto and Hangjung (2012), and factors Influencing acceptance adopting AI: Sweden case by Stenberg et al. (2020) use five indicators as used in this study. These include ICT expertise, ICT infrastructure, top management support, staff capacity, and regulatory environment. Two indicators consisting of perceived model usefulness and the basic model were added to this study. Furthermore, the perceived usefulness is often used as a benchmark. The basic model as a suggestion to be a technology-related factor to influence innovation adoption and an indicator of citizen participation explaining collaboration with external parties such as academics, consultants, citizens, and the private sector are some of the essential factors for successful adoption.

In a study conducted by Pudjianto and Hangjung, the model used a direct relationship between constructs and formatives. Furthermore, moderating effects were used to describe the relationship between e-government assimilation and the type of organization. The same model was also adopted by Stenberg, which also uses a direct relationship between the constructs of technology, organization, and environment with a formative

construct model. This study examines the direct relationship between constructs with formative and reflective models. The indicators presented in the models of the three studies have the same results. Meanwhile, the indicators that have a significant influence include top management support and the regulatory environment. It is a concern in the adoption of innovation, support from management is not enough to be accompanied by precise regulatory arrangements.

The novelty of this model explains that the technology dimension is not significant enough in the adoption of innovation. The adoption is strongly influenced by staff capacity, environmental regulatory support, and clear targets. It is different from the previous two models, which explain that the technology dimension has a significant influence on adoption, such as indicators of ICT infrastructure, relative advantages, and compatibility. This is because of its significant impact on the development and maintenance process.

5.3 Limitation and Future Research

The limitation is that this study uses an online questionnaire distributed to the central and local governments. This method is effective because many people can access and give their opinions about the chatbot platform. However, the method resulted in many errors in the data caused by unacceptable responses and some questions that the respondents did not understand. This study also focuses on the chatbot platform to not be generalized in the overall implementation of AI-based public services. The sample collected only includes civil servants that have used and provided chatbot platforms in their public services.

Future study is expected to input three new constructs into the model: security, risk, and integration. This model provides a more comprehensive understanding of system integration on adoption intentions and demonstrates security in controlling related issues. Furthermore, the adoption of artificial intelligence technology will continue to grow, therefore, it is necessary to measure the readiness of the government and society in implementing AI.

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<Appendix A> Questioner

Regarding the research that I did, I hope that your participation will take approximately 10-15 minutes to fill out this survey. The data you provide will only be processed for the benefit of the wider community and provide input to the government and policy makers. This survey consists of 2 parts questions regarding your profile and perception in the implementation of artificial intelligence-based public services such as chatbot platform services.

Your participation is very meaningful in determining government policies related to Indonesia's national artificial intelligence strategy towards the industrial revolution 4.0.

Personal Information

1. Origin of Institution:
   a. Central Government
   b. Regional Government
2. Role in the Institution:
   a. Director-General
   b. Director
   c. Coordinator
   d. Sub-Coordinator
   e. ICT Staff/ICT Expert
3. Age:
   a. <30 years
   b. 31-40 years
   c. 41-50 years
   d. >51 years
4. Number of public services under the institution:
   a. <5
   b. 6-10
   c. >10
5. Status of AI-based public services implementation:
   a. Yes
   b. No
   c. Uncertain

Furthermore, the survey below will assess your perception regarding the development, adoption and implementation of artificial intelligence-based public services such as chatbot platform services using a Technological, Organizational and Environment (TOE) framework approach.

1 = strongly disagree, 2 = disagree, 3= neutral, 4 = agree, 5 = strongly agree

6. Perceived Usefulness: Using this technology can improve their performance.

	1	2	3	4	5
Using chatbot platform can improve the performance of the institution					
Using chatbot platform can speed up services to citizens					
Using chatbot platforms is very useful in					

reducing face to face in public services					

7. ICT Expertise: By having the ability, knowledge, and skills, organizations tend to adopt and implement innovations more quickly.

	1	2	3	4	5
Our institution is supported by personnel who have special expertise or knowledge in the field of ICT					
Our institution conducts benchmarking with other institutions to update knowledge in the field of ICT					

8. ICT Infrastructure: ICT infrastructure provides support in developing technical knowledge, developing managerial skills, and also how to optimize the technology.

	1	2	3	4	5
Utilizing the National Data center will give positive impact to chatbot platform system					
With increasing the internet speed will support the chatbot platform system					
The broadband coverage in all regions of Indonesia can indirectly strengthen ICT sector in terms of chatbot platform adoption					

9. Top Management Support: Commitment to managerial trust to actively participate and to initiate innovation in adoption.

	1	2	3	4	5
Top management support the implementation of chatbot platform					
Top management sets goals and standards in the implementation of the chatbot platform					
Top management is willing to take risks that result from implementing the chatbot platform system.					

10. Staff Capacity: Measuring employees in the IT field will usually calculate the total number of employees who are capable and have expertise in installing, maintaining, developing, and solving IT-related problems.

	1	2	3	4	5
Top management support the implementation of chatbot platform					
Top management sets goals and standards in the implementation of the chatbot platform					
Top management is willing to take risks that result from implementing the chatbot platform system.					

11. Regulatory Environment: important factor in environmental dimensions that influence innovation adoption.

	1	2	3	4	5

Government laws and regulations support the initiative and implementation of the chatbot platform					
The implementation of the chatbot platform in public services is included in the national priority					

12. Citizen Participation: collaboration with externals such as academics, consultants, citizens, the private sector, and the community are some of the key factors for successful adoption.

	1	2	3	4	5
The government involves the community, academia, expertise related to service needs.					
The government provides an information to the public about how to use the chatbot platform system.					

13. Intention to adopt: the strength a person desires to perform a particular behavior.

	1	2	3	4	5
Overall, currently our institution is interested in using the chatbot platform to improve services to the community					
Our institutions are interested in technological developments such as chatbot platforms to speed up bureaucratic processes and decision making in the next year					

Thank you for your participation.

<Appendix B> Summary Measurement Model

1. Measurement model

Variable	Indicator	Outer Loading	Cross Loading				AVE	CR
			Intention to adoption	Technology	Organizational	Environment		
Intention to adoption	IA1	0.923	0.923	0.581	0.702	0.599	0.865	0.928
	IA2	0.938	0.938	0.61	0.74	0.73		
Technology	IE1	0.93	0.592	0.93	0.647	0.506	0.685	0.945
	IE2	0.871	0.598	0.871	0.633	0.52		
	II1	0.77	0.384	0.77	0.428	0.364		
	II2	0.88	0.468	0.88	0.583	0.346		
	II3	0.819	0.528	0.819	0.554	0.509		
	PU1	0.741	0.546	0.741	0.58	0.443		
	PU2	0.756	0.551	0.756	0.575	0.472		
	PU3	0.834	0.51	0.834	0.545	0.416		
Organizational	SC1	0.809	0.584	0.489	0.809	0.462	0.636	0.897
	SC2	0.838	0.733	0.585	0.838	0.627		
	SC3	0.788	0.639	0.573	0.788	0.629		
	TMS2	0.798	0.613	0.615	0.798	0.503		
	TMS3	0.751	0.482	0.494	0.751	0.333		
Environment	CP1	0.708	0.48	0.4	0.414	0.708	0.651	0.881
	CP2	0.775	0.537	0.37	0.437	0.775		
	RE1	0.846	0.624	0.45	0.606	0.846		
	RE2	0.888	0.658	0.535	0.628	0.888		

2. Structure model

Hypothesis	Path	Path Coefficient	T Statistics	Test result		f2	Influence
H3	Environment -> Intention to adoption	0.345	5.97	Accepted	0.345	0.211	Medium
H2	Organizational -> Intention to adoption	0.456	6.019	Accepted	0.456	0.273	Medium
H1	Technology -> Intention to adoption	0.134	2.559	Accepted	0.134	0.029	Low
H3b	CP1 <- Environment	0.708	16.191	Accepted			
	CP2 <- Environment	0.775	20.802				
H3a	RE1 <- Environment	0.846	36.322	Accepted			
	RE2 <- Environment	0.888	52.737				
H2b	SC1 <- Organizational	0.809	21.319	Accepted			
	SC2 <- Organizational	0.838	47.733				
	SC3 <- Organizational	0.788	24.275				
H2a	TMS2 <- Organizational	0.798	24.467	Accepted			
	TMS3 <- Organizational	0.751	15.739				
H1b	IE1 <- Technology	0.93	76.228	Accepted			
	IE2 <- Technology	0.871	26.103				
H1c	II1 <- Technology	0.77	16.928	Accepted			
	II2 <- Technology	0.88	32.852				
	II3 <- Technology	0.819	22.229				
H1a	PU1 <- Technology	0.741	19.312	Accepted			
	PU2 <- Technology	0.756	20.888				
	PU3 <- Technology	0.834	22.872				

초 록

최근 들어, 많은 국가에서 인공지능(AI; Artificial Intelligence) 기반 사회를 위한 AI 구축 전략을 쓰고 있다. AI는 다양한 기술을 필요로 하며 적용사례를 사회 전반에서 찾아볼 수 있는데, 그중 하나는 시간, 비용적으로 효율적이며 높은 질의 공공 서비스 제공이 가능한 챗봇이다. 2019년 인도네시아 정부는 코로나-19 감염증에 관련된 기본적인 정보를 제공할 수 있는 AI 기반 챗봇을 출시했는데, 약 2억 5천만 인구 중 약 2백만 명 만이 사용했다. 본 연구의 목적은 인도네시아에서 챗봇 서비스를 보급하는 데에 있어서 문제가 되는 기술적, 조직적, 환경적 요인들을 조사하는 것이며, 이를 바탕으로 보급을 위해 고려 할 만한 사항들을 인도네시아 정부에 추천하는 것이다.

주요어 : 인공지능, 인공지능 기반 공공 서비스, 챗봇 서비스, 기술 조직환경 토대(TOE; Technology- Organizations-Environment)

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